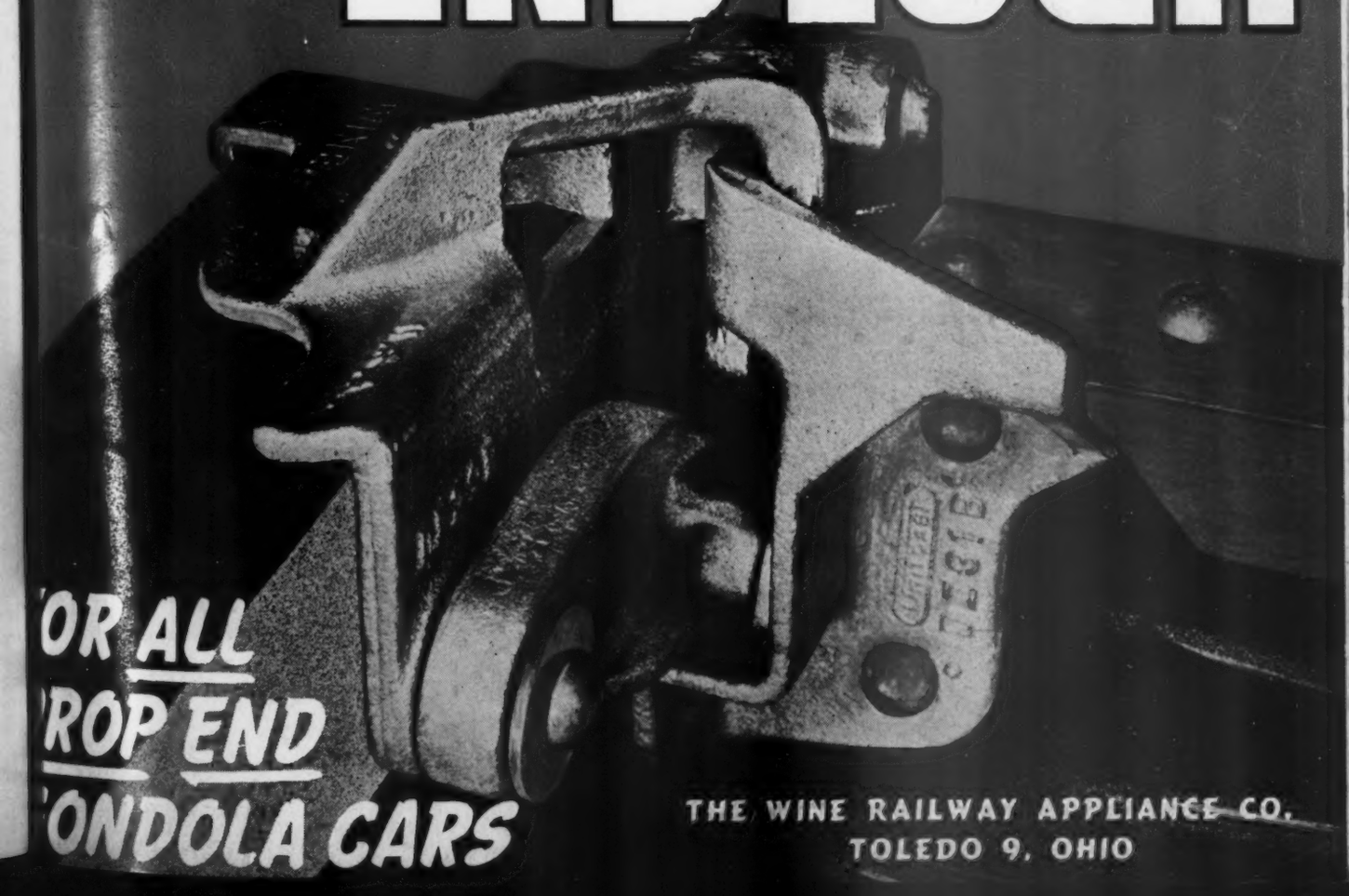
RAILWAY
Mechanical and
Electrical Engineer

JUN 14 1950

JUNE, 1950

Interlocking
WINE
DROP
END LOCK



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VOLUME 124 — No. 6

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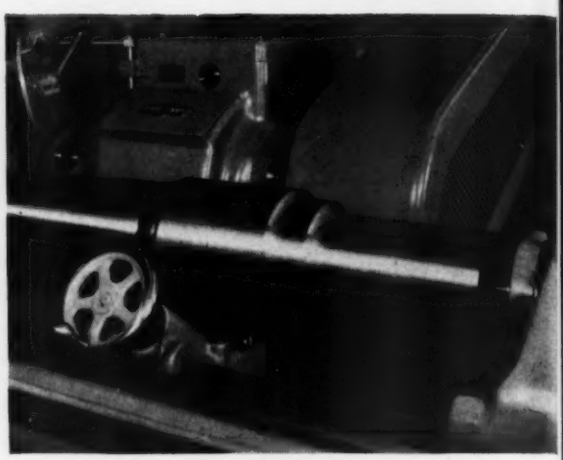
RAILROAD CAR WHEEL AXLES QUICKLY PRECISION GROUND

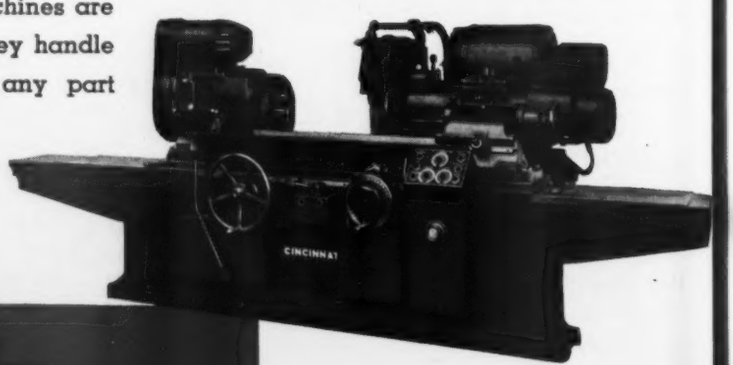
ON NEW CINCINNATI FILMATIC 14" AND 16" PLAIN GRINDERS

These illustrations give you an excellent indication of the performance which you can expect from CINCINNATI FILMATIC 14" and 16" Plain Grinding Machines. The part is a railroad car wheel axle. Several diameters are ground to accurate dimensions, and at the same time, the adjoining radii are also ground. The wheel is trued to the desired radius by means of a profile wheel truing unit with interchangeable cams. (Extra equipment.) ¶ FILMATIC grinding wheel spindle bearings, simple table traverse drive with electronic rate control and automatic pressure way lubrication, and conveniently located mechanical and electrical operating elements, contribute largely to the machine's dependable performance. ¶ CINCINNATI FILMATIC 14" and 16" Plain Grinding Machines are not limited to grinding car wheel axles; they handle plain precision grinding operations on any part within their range. Complete information may be obtained by writing for catalog No. G-594.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO



Diameters and radii of railroad car wheel axle ground on the CINCINNATI FILMATIC illustrated above. One of the loading cradles is shown to advantage in this setup.



New CINCINNATI FILMATIC 16" x 36" Plain Grinding Machine. Also built in 14" size. Both 14" and 16" machines are built in 36", 48", 72", 96", 120", 144" and 168" lengths.

CINCINNATI FILMATIC 16" x 120" Plain Grinding Machine with profile wheel truing equipment and loading cradles to facilitate grinding operations on railroad car wheel axles.

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CENTER TYPE GRINDING MACHINES CENTERLESS LAPPING MACHINES
CENTERLESS GRINDING MACHINES MICRO-CENTRIC GRINDING MACHINES

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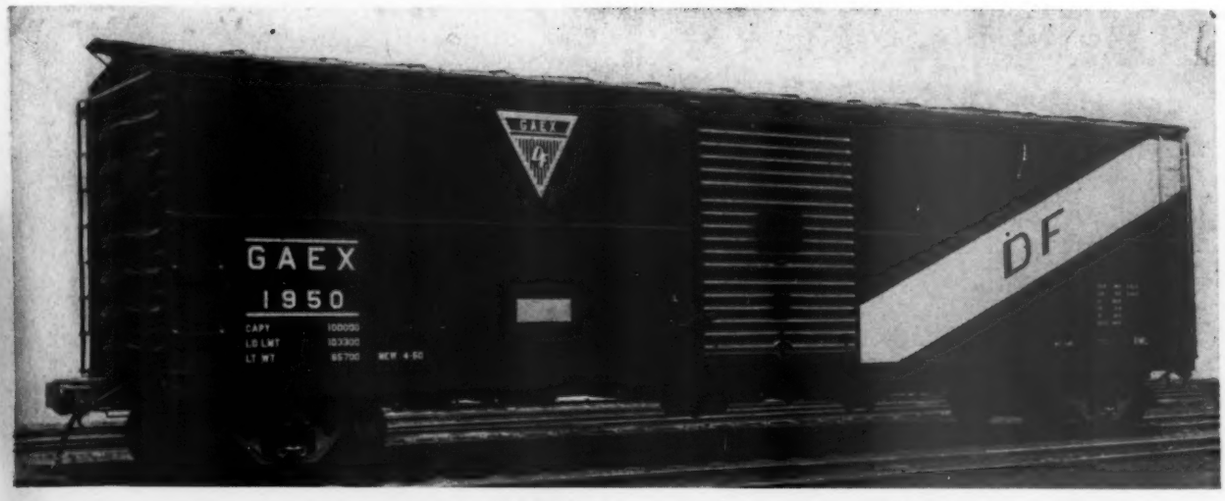
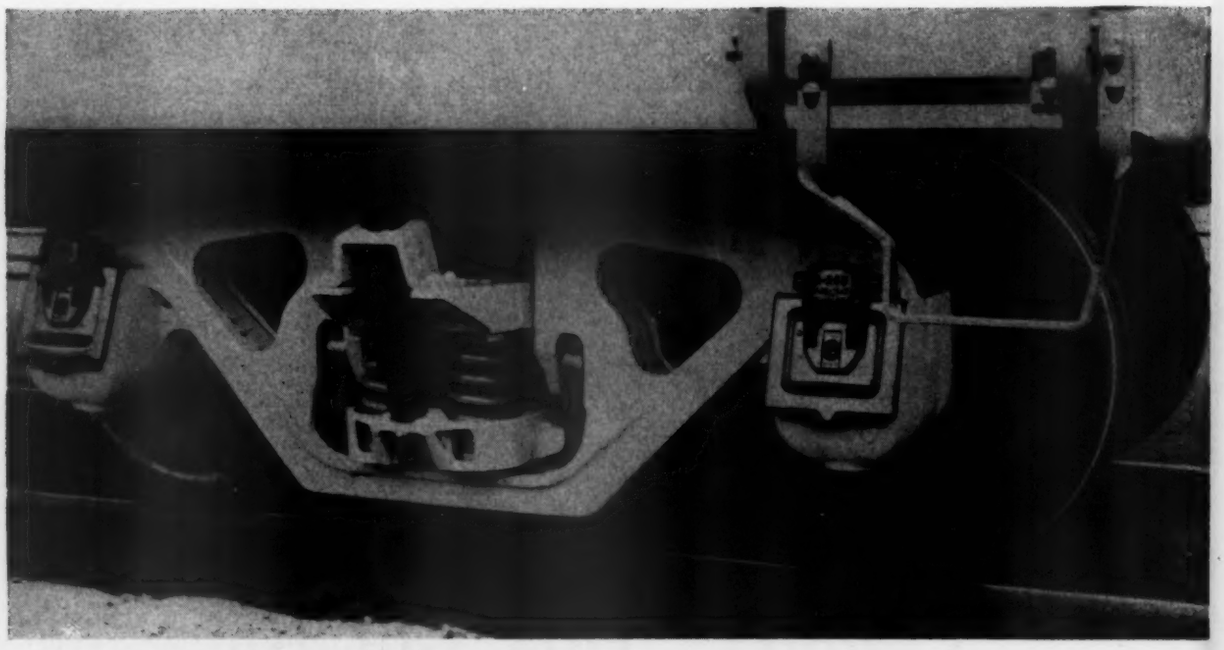


"Quality" Box Car for Lease to Railroads

Among objectives of General American-Evans are low maintenance cost, capacity loading with reduced damage, high monthly mileage and increased net earnings

THE main objectives of the GAEX 50-ton box car include maximum service to the shipper, capacity loading, high monthly mileage, low maintenance costs, reduced damage claims, with consequent net earnings substantially more than enough to cover a first cost about 50 per cent above that of conventional present-day box cars. These cars are now under construction by the General American-Evans Company, Chicago. They will be for lease to the railroads.

Six advanced features, already known but not combined before in a single car, are incorporated in the GAEX design. These include the Damage-Free loading device, Duryea cushion underframe, high-speed trucks of Chrysler design, 8-ft. doorways to facilitate loading and unloading with lift trucks, the nailable steel floor, and the diagonal panel roof. No attempt has been made to design a car of exceptionally light weight. In fact, openhearth copper-bearing steel is employed for most of the structure, which is strengthened above the average in a number of details. This, together with the special devices installed, brings the light weight of the car up to 59,240 lb. without the movable parts of the loading device.



The Chrysler-design high-speed truck

GENERAL DIMENSIONS OF GAEX 50-TON BOX CAR

Length inside, ft.-in.	50–6
Width inside, ft.-in.	9–2½
Height inside, ft.-in.	10–6
Cubic capacity, cu. ft.	4,872
Length over end sills, ft.-in.	50–8¼
Length over strikers, ft.-in.	53–0
Width over sheathing, ft.-in.	9–11⅜
Width over side plates, ft.-in.	10–0¼
Distance between truck centers, ft.-in.	40–11¾
Truck wheel base, ft.-in.	5–6
Side door width, ft.-in.	8–0
Height top of rail to eaves, ft.-in.	14–5
Height rail to running board top, ft.-in.	15¼
Weight without D-F movable parts, lb.	59,240

To make possible capacity loads, minimize damage to lading, and to eliminate dunnage and incidental labor costs, the car is equipped with the Evans D-F loading device which has been in successful use for a number of years and is said to increase the average safe pay load about one-third. This device also facilitates the quick application and safe handling of partial loads as well as full loads of any kind, shape or size of material normally transported in box cars.

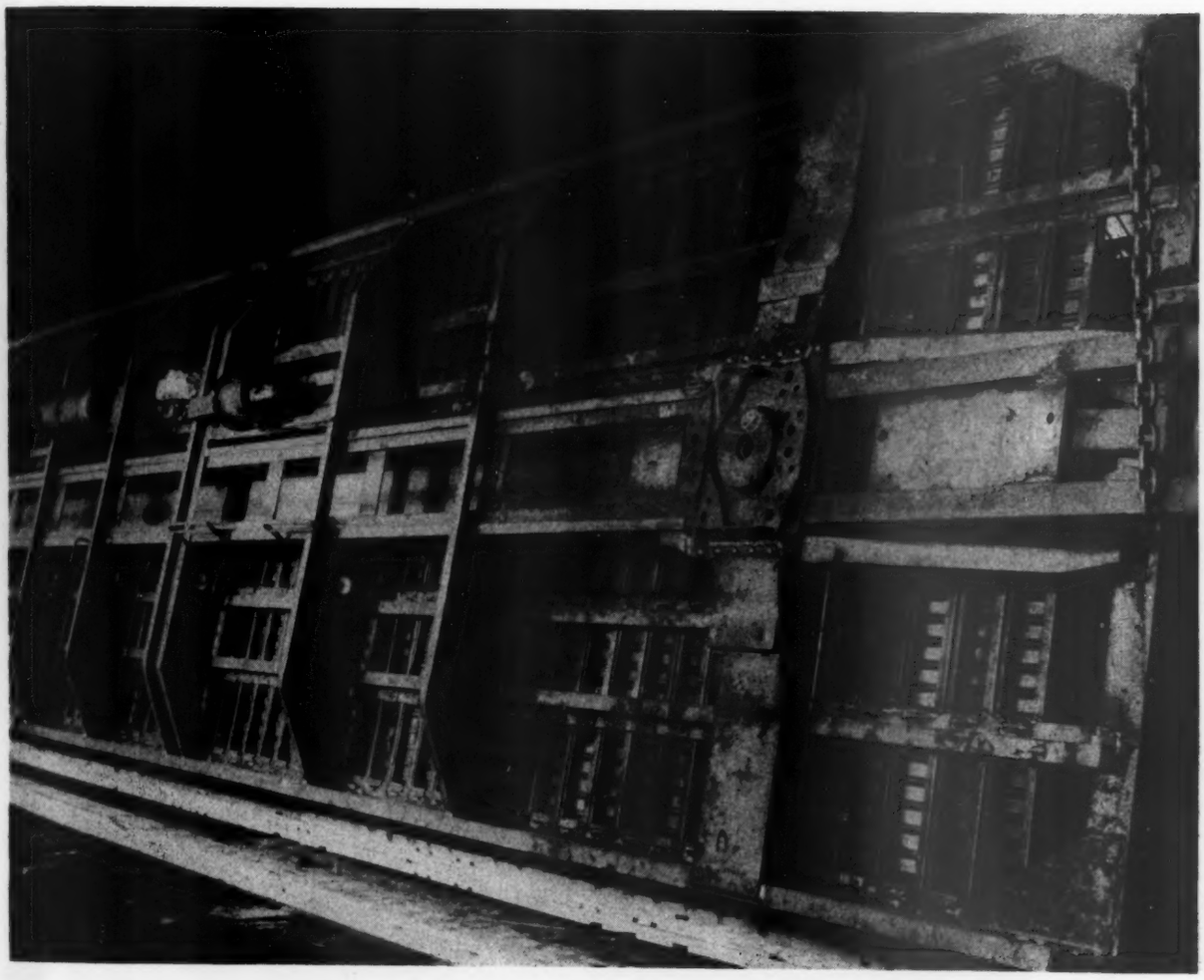
The D-F loader consists of angles, punched for cross members, applied horizontally from door post to corner post, welded to all posts, with removable sections of angle to apply in door openings, and cross members equipped with a locking device at the ends. There are eight rails per car side.

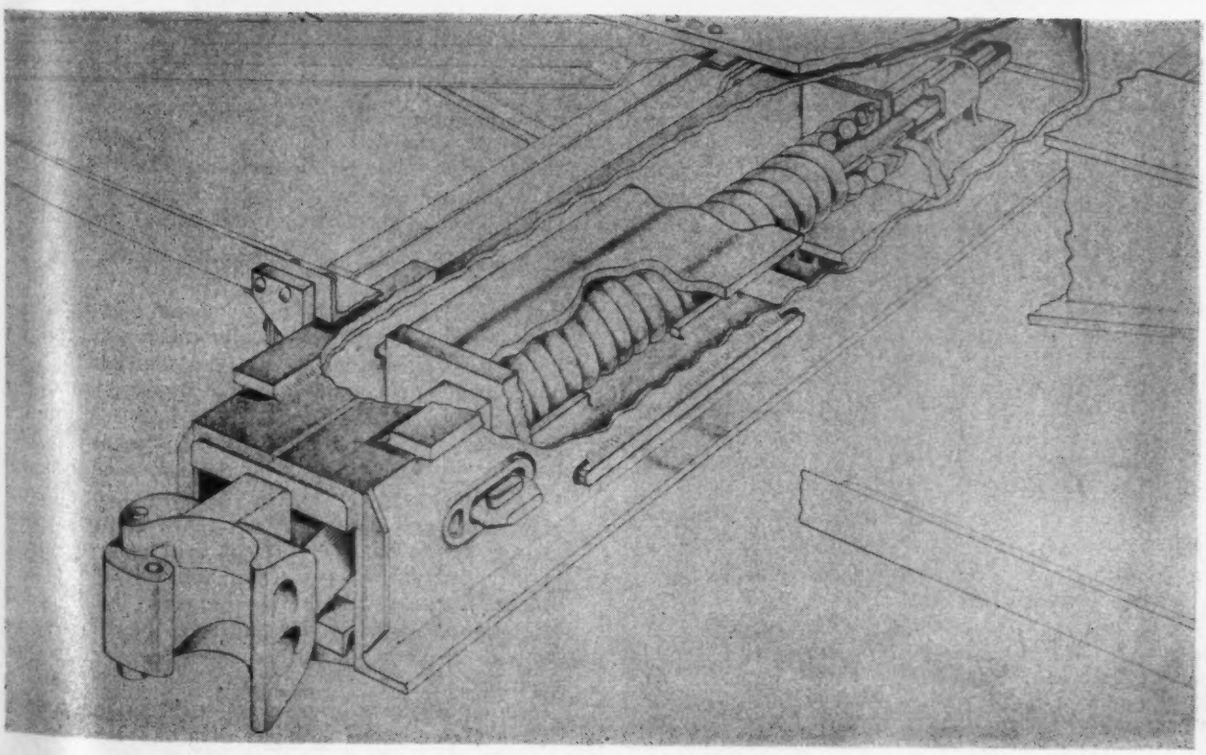
Specifications for the new GAEX car call for use of the Duryea welded-type, single-spring cushion underframe to give greater protection for both car and lading under horizontal shocks incident to train handling in road service and switching. This device, which utilizes springs in both ends of the car to cushion each train shock, regardless of direction, has a travel of 7 in., as compared with 2¾ in. for conventional draft gears, and is said to develop 36,000

Top (page 311): The underframe of the D-F car; Below: Sectional view at one end of the Duryea single-spring welded type underframe

PARTIAL LIST OF MATERIALS AND EQUIPMENT ON GAEX 50-TON D-F BOX CAR

Truck side frames, bolsters, springs, spring planks, swing hangers and snubbers	Symington-Gould Corp., Depew, N. Y.
Brake beams	Chicago Malleable Castings Co., Chicago
Brake-beam hangers and retainers, brake levers and bottom connections	Schaefer Equipment Co., Pittsburgh, Pa.
Brake beam guard	Chicago Railway Equipment Co., Chicago
Brake shoes and keys	American Brake Shoe Co., New York
Side bearings	Standard Car Truck Co., Chicago
Journal bearings	Magnus Metal Corp., Chicago
Journal-bearing wedges	Clifford-Jacobs Forging Co., Champaign, Ill.
Journal-box lids	Symington-Gould Corp., Depew, N. Y.
Wheel and axles	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Air-brake equipment	Westinghouse Air Brake Co., Wilmerding, Pa.
Duryea cushion underframe	Hulson Co., Chicago
Couplers	American Steel Foundries, Chicago
Coupler-release rigging, roofs and ends	Standard Railway Equipment Company, Chicago
Door and fixture	Camel Sales Company, Chicago
Running boards and brake steps	Blaw-Knox Co., Pittsburgh, Pa.
Hand brakes	W. H. Miner, Inc., Chicago
Brake-pipe anchor, draft-key retainer	Illinois Railway Equipment Co., Chicago
Pipe clamps	Central Railway Supply Co., Chicago
Defect-card holder	Apex Railway Products Co., Chicago
Loading device	Evans Products Company, Detroit, Mich.
Nailable steel floor	Great Lakes Steel Corp., Detroit, Mich.

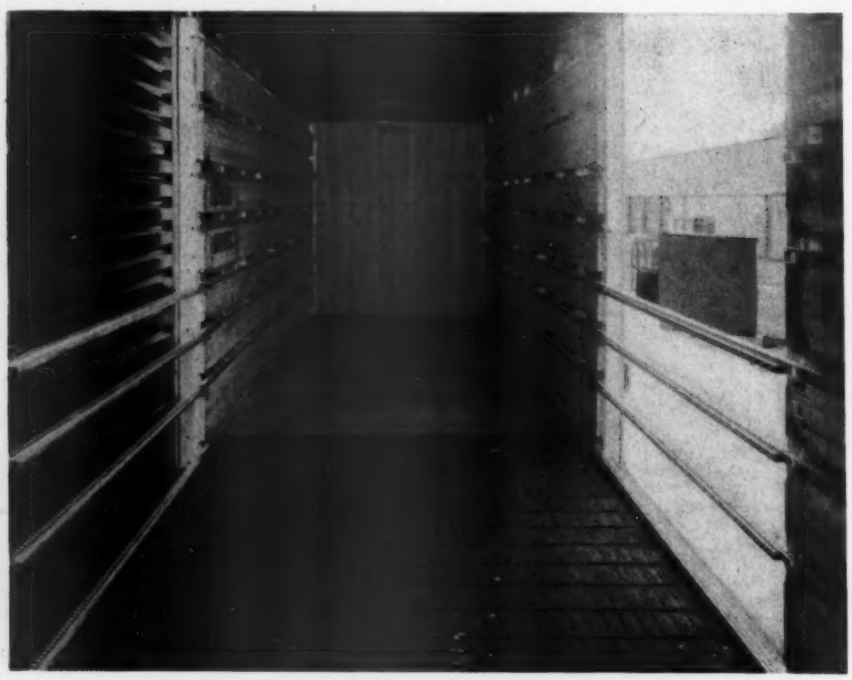




ft. lb. of cushioning capacity, or twice the minimum specified by the A.A.R. for '50-ton cars.

On the basis of extensive service experience on many thousands of freight cars and cabooses during the last 20 years, the builder believes that this cushioning device, as installed on the GAEX car, will not only reduce damage claims and car repair costs, but permit higher safe switching speeds, reduce slack action roughly 85 per cent, minimize hot boxes due to unseated journal bearings and attendant waste grabs, and provide positive coupler centering by spring pressure on the coupler follower plate.

For the protection of both car and lading in high speed operation, Chrysler-design railroad freight-car trucks are installed. These are equipped with springs having $3^{11}/_{16}$ in. travel and friction snubbers also of Chrsyler design. The balanced suspension is said to absorb vertical shocks by the relatively long-travel high-capacity coil springs and smooth-acting snubbers, and lateral shocks by the pendulum action of



The nailable steel floor extends the full length of the D-F car and is covered with a mastic material—Removable side sections show at the doorways—Below: Side-wall construction—The interior of the roof is treated to prevent condensation

short, self-alining swing hangers. The design provides positive side-frame alinement by the combined rigidity of the spring plank and hanger assembly.

General Mechanical Design

The GAEX car is designed to standard specifications for the A.A.R. 50-ton all-steel box car with a number of interesting features in addition to those mentioned. For example, the A.A.R. Z-section center sill, weighing 41.2 lb. per ft., is heavier than the usual center sill. In addition to the standard A.A.R. 6-in. by $5/16$-in. by 3½-in. angles side sill, a continuous 8-in. channel, weighing 18.75 lb. per ft., extends from end sill to end sill. This eliminates possible weakness in the 8-ft. clear door opening which is provided for easy loading and unloading with power lift trucks. An additional cross bearer is added to the underframe in the center of the doorway to support the floor sill further and strengthen the underframe.

Door posts have been increased in section to give 100 per cent more strength than the conventional

A.A.R. design. This provides better construction and prevents damage caused by loading trucks. The posts are riveted to the side sills and side plates and braced by use of heavier gussets than usually applied.

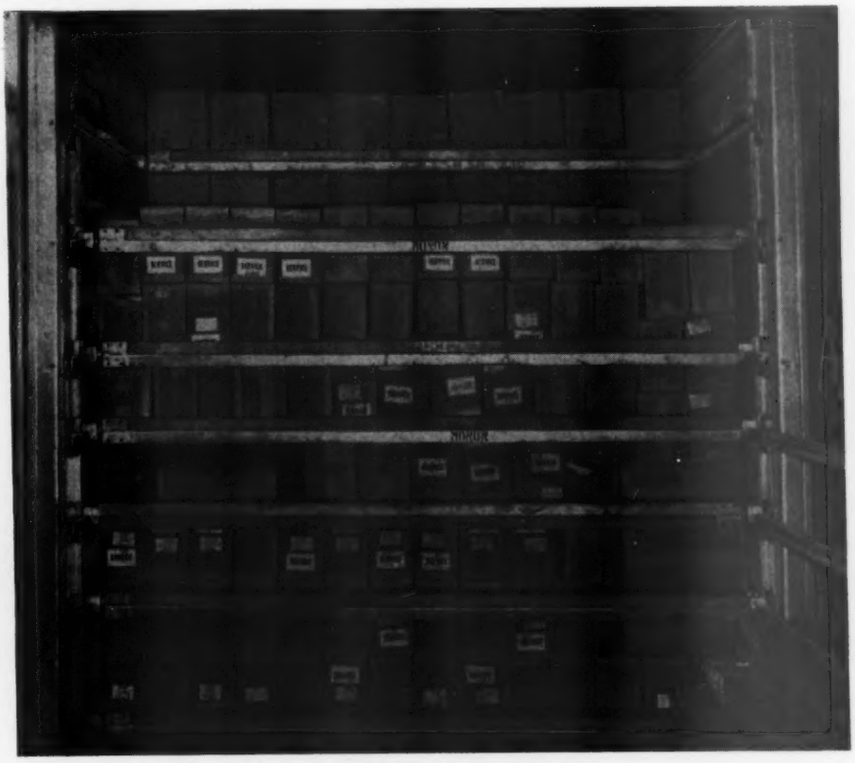
A nailable steel floor, made of high-strength low-alloy steel, gives greater strength and three to five times greater resistance to corrosion. The floor is welded to the side sills and to four Z-section floor stringers, two on each side of the center sill. In addition to exceptional strength, this floor, as the name implies, permits the application of blocking with nails which may be pulled out and redriven without damaging the floor as in the case of wood floors. The floor is coated with a non-skid, no odor, rub proof mastic. The mastic material is imbedded in indentations in the floor strips which prevents movement under lift truck wheels.

The car side posts, 28 per cent are made of 3 in., 5.1 lb. Z-sections securely riveted to the side plate, side sill and side sheets. The spacing is 2 ft. 8 in. on centers, which is less than the A.A.R. spacing.

Sidesheets are applied horizontally to the car thus eliminating approximately 200 ft. of vertical lap-seam joints. This design is intended to provide a car side in which corrosion at the vertical lap joints will be eliminated and maintenance costs proportionately reduced.

The car roof is the riveted diagonal panel type, made of 14-gauge galvanized steel. The inside lining consists of yellow pine, $1\frac{5}{8}$ in. thick, square edge, applied horizontally from door post to corner post in sections between the loader angles, secured by $\frac{1}{4}$-in. studs welded to the steel posts. The end lining is $^{25}/_{32}$ in. thick by $5\frac{3}{16}$-in. face, tongue and groove.

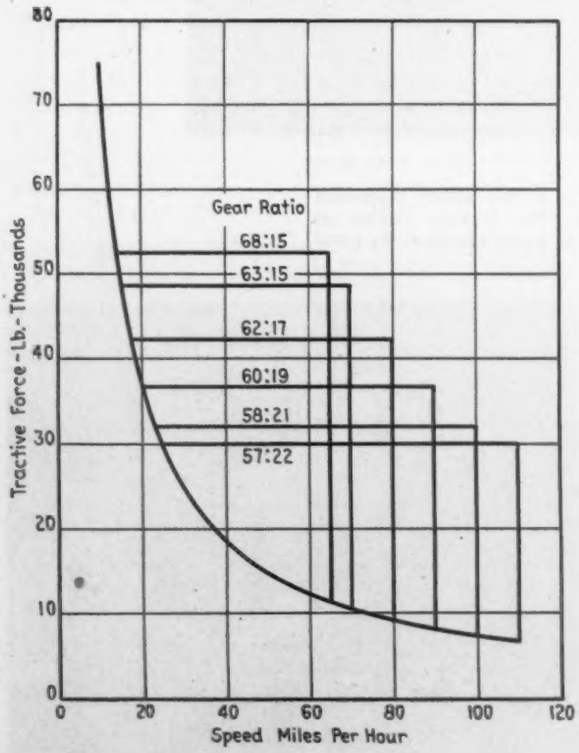
The exterior finish of the car is Dulux green freight-car enamel with black roof and trucks and yellow stenciling and striping. Provision is made for the addition of steam and signal lines to operate the car in passenger head end service.



Typical example of merchandise in cartons safely supported by D-F loading device—Below: The locking device at each end of each cross member is easily operated by hand

Fairbanks–Morse

THE Fairbanks-Morse Consolidation Line of Diesel-electric locomotives comprises units with power plant ratings of 1,600, 2,000, and 2,400 hp. in one standard basic structure. Both freight and passenger units in all three horsepower ratings have the same chassis and are built around standard sub-assemblies which are interchangeable between units for either service and in any rating. All are powered by a single Fairbanks-Morse opposed-piston engine in which only the number of cylinders is varied to suit the power output requirements.



The speed-tractive force curve for the 2,400-hp. C-Line locomotive

Two different wheel arrangements are used, B-B or B-A1A. Two four-wheel trucks are used where possible for maximum traction. A six-wheel truck, with a center idler axle, is substituted for the rear four-wheel truck when needed to support the additional weight resuling from the addition of a heating boiler, or to keep axle loads to a minimum where required

The C-Line 2,400-hp. passenger locomotive establishes a new high in horsepower per unit of length —42½ hp. per ft. It is 20 tons lighter than the previous Fairbanks-Morse passenger units of only 2,000-hp. with the conventional A1A-A1A running gear. At the same time, the weight on drivers is increased by 4 tons. This saving in weight ,plus the increase in horsepower and weight on drivers, permits handling about one more car per Diesel unit.

In general, Consolidation Line freight locomotives have two four-wheel trucks for all three horsepower ratings to provide maximum starting traction. The 1,600-hp. passenger locomotives also have two four-wheel trucks, while the two larger passenger ratings have a six-wheel rear truck to support the weight of the heating boiler and water. All three ratings for either freight or passenger service have 42-in. wheels to keep the running gear loading within the limits of the A. A. R. and the A. R. P. A. Nine gear ratios are available with any horsepower rating to furnish the desired combination of speed and tractive-force characteristics.

The 2,400-hp. passenger locomotive has a maximum permissible speed of 110 m.p.h., yet develops a continuous tractive force of 30,000 lb. at 25.6 m.p.h. The 1,600- and 2,000-hp. units have this same continuous rating at 16.1 and 20.8 m.p.h., respectively. With a 68:15 gear ratio, the freight units have 52,500-lb. continuous tractive-force rating at 9.2, 11.9 and 14.4 m.p.h. for the 1,600-hp., the 2,000-hp., and the 2,400-hp. units, respectively.

"Consolidation Line" Diesels

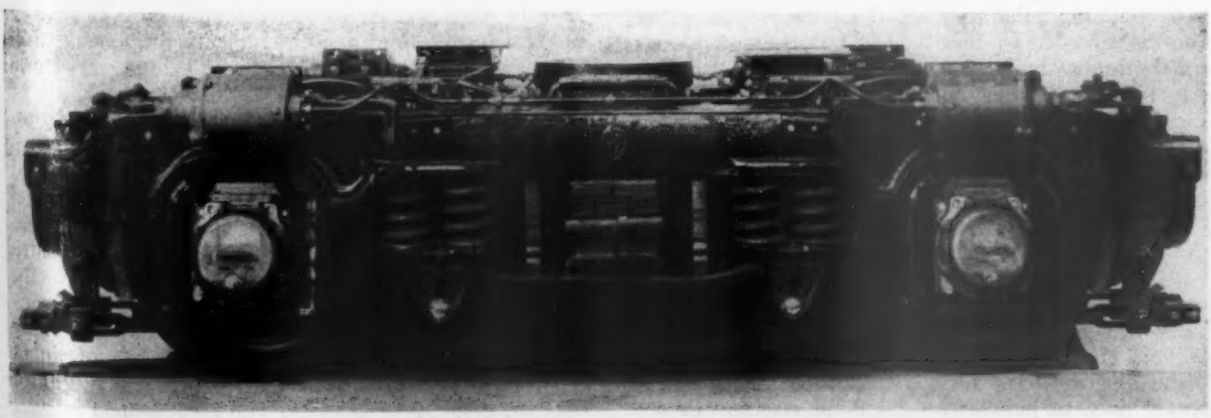
Units with 1,600 to 2,400-hp. have the same chassis and are built around interchangeable subassemblies

A feature of the design of the Consolidation Line is the constructor around standard subassemblies which are assembled in the locomotive by connecting preset wires, piping, etc. All like subassemblies are interchangeable, and all connections are standard.

The 4,800-hp. Passenger Locomotive

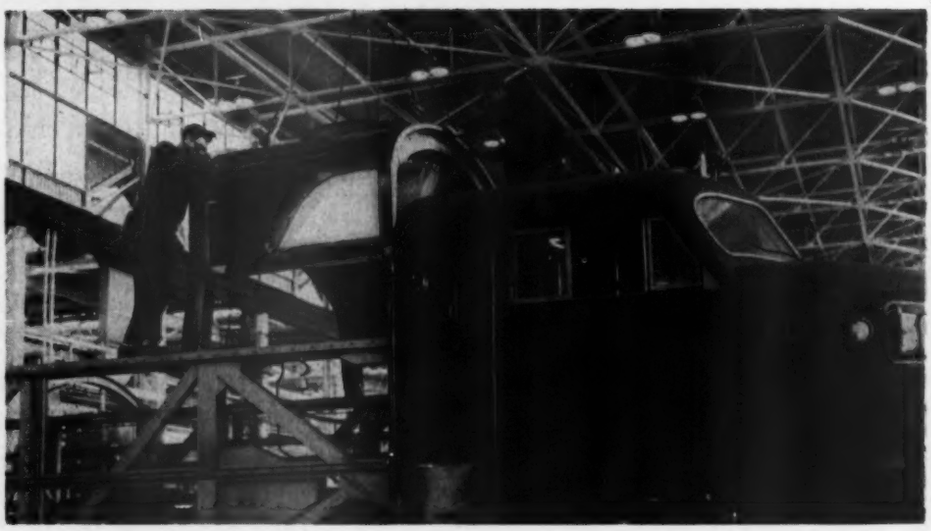
A feature of the basic structure is the design and location of the top chord of the side truss. This chord runs continuously from the bulkhead at the rear of the operating cab to the rear collision post. It is located just below the louvers which extend the full length of the engine compartment. The three roof or hatch sections are fastened to the locomotive by large-diameter bolts through the top chord.

This method of construction serves two purposes. First, the roof sections are interchangeable. The No. 1 hatch contains the dynamic-brake equipment, when required, and the No. 3 hatch contains the entire engine cooling system. Therefore, maintenance of such equipment can be carried out by substitution of spares with a minimum out-of-service time for the locomotive. These two roof sections contain wiring or piping with suitable standard connections, and are generally designed for easy removal and replacement. The third or No. 2 hatch extends over the engine and has no



All parts except the frames, bolsters equalizers and spring hangers are interchangeable between the four- and the six-wheel trucks

When the hatches are removed, the inherently narrow design of the opposed-piston engine affords accessibility for maintenance



The top chord of the side truss is about 2 ft. below the top of the locomotive, resulting in a minimum of lifting to remove the engine — The three roof hatches, complete with subassemblies, bolt to this chord.

subassembly. It does have an access cover that extends over the top of engine. The cover is divided into three hinged sections, each light enough for one man to life, so that liners and other small parts can be replaced without removing the center roof hatch.

Second, the quick removal of a large section of the roof as afforded by this type of construction speeds up the removal of large pieces of equipment which may require overhaul, such as the steam generator or air compressor. The lower location of the top chord also permits replacement of parts with 2 ft. less lift, an advantage to those shops with limited overhead clearance.

Two arches are incorporated in the structure to tie the side trusses together and to avoid stressing the hatches. One arch is located near the front of the engine compartment and the second is near the rear. They are far enough apart that all 1,600- and 2,000-hp. engines can be applied or removed without disturbing the arches. The front arch requires removal only to handle the 2,400-hp. engine. In securing the hatches to the side truss, bolt-hole alignment is attained by the use of tapered mating members both on the side-truss frame and the hatch cover.

The larger equipment components, such as air brake, electrical, main engine and auxiliaries, and the steam generator equipment have been definitely grouped in the general arrangement of the basic units so as to isolate disparate maintenance functions.

The entire design is aimed toward interchangeability of all major assemblies between basic units of any horsepower rating, as well as interchangeability of small replacement parts within those major assemblies.

Dynamic-brake equipment together with appropriate interlocking of the dynamic-brake system and the air-brake system can be installed on any model during construction or after placing in service. Coupler centering devices are incorporated to assure proper alinement of the locomotive units in dynamic brake operation.

The basic design of the Vapor steam generator equipment is arranged for ready application of single steam generators which range from 1,600 to 4,000 lb. per hr. generating capacity. The arrangement is such that the steam generator is completely accessible from three sides and across the top surface. Passenger

units can carry up to 2,000 gal. of water, 700 in the middle, or main, storage tank, and the remainder equally divided between two long, thin tanks which are mounted on each side of the locomotive body. The three tanks are filled simultaneously from the top and are connected for supplying the boiler at the floor level.

The air-brake equipment, all of which is located between the air compressor and the No. 1 end collision post, has been designed for application of all ramifications of the No. 24RL air brake schedule without change in piping or rearrangement of the various pieces of equipment. All pieces are accessible for removal, cleaning and inspection, independent of other pieces.

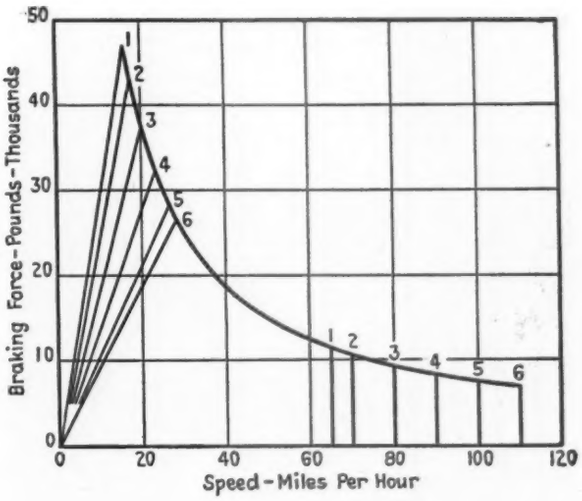
Space has been planned and reserved in the basic unit for installations of the largest combinations of train control, cab signal and train communication equipment in use or known to be contemplated. The locomotive control equipment has been designed so that it is readily adaptable by minor changes for multiple-unit operation with locomotives of other manufacture.

The fuel capacity, normally 1,200 gal., may be increased subject to clearance and axle loading specifications of the railroad.

The locomotive has been simplified through the use of alternating-current auxiliary equipment with the alternator mounted on the air-compressor shaft. A further simplification is the use of permanent series-parallel traction-motor connections with the progressive steps of traction-motor field shunting to match the traction-motor characteristics to the main generator characteristics through the entire speed range of the locomotive.

Underframes are built of steel plates and shapes welded into unit construction. Center sills are joined with cab sides of truss construction by welded cross members. The floor consists of steel plates welded to the underframe upon which non-skid flooring is applied for engineroom passageways and the nose floor.

Rubber-cushion draft gears are applied at each end with draft-gear pockets of welded construction built integral with underframe. Passenger units have A.A.R. Type H tight-lock couplers and rubber draft gear used in conjunction with spring-loaded centering devices. Freight units have Type E couplers. A welded steel pilot is fitted with double-hinged portions which can be retracted to provide generous clearance when the number one end of an A-unit is coupled to the train. The underframe has a body bolster located both slightly ahead of and slightly to the rear of the rear engine compartment door to permit changeover between a four-wheel and a six-wheel truck any time during the life of the unit.

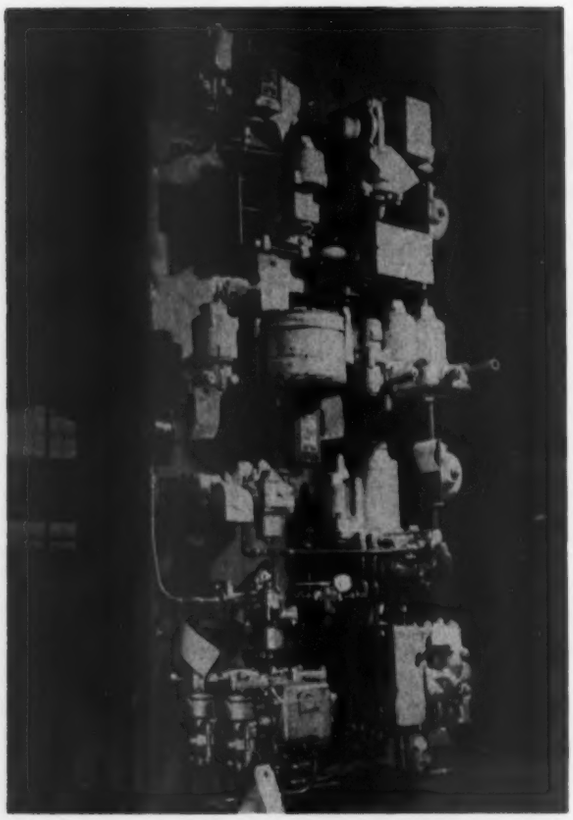


Curve No.	Gear ratio	Maximum Braking force, lb.	Speed, m.p.h.
1	68:15	46,500	65
2	63:15	43,000	70
3	62:17	37,300	80
4	60:19	32,300	90
5	58:21	28,250	100
6	57:22	26,300	110

The dynamic braking curve for all Consolidation Line Locomotives

GENERAL CHARACTERISTICS AND DIMENSIONS OF THE FAIRBANKS-MORSE CONSOLIDATION LINE DIESEL-ELECTRIC LOCOMOTIVE UNITS

Service	Freight	Passenger	Passenger	Freight	Passenger	Freight	Passenger
Type:							
Whyte symbol	0-4-4-0	0-4-4-0	0-4-6-0	0-4-4-0	0-4-6-0	0-4-4-0	0-4-6-0
A.A.R. symbol	B-B	B-B	B-A1A	B-B	B-A1A	B-B	B-A1A
Weights (in working order) lb.:							
Total fully loaded	244,000	256,000	280,000	252,000	289,000	257,000	294,000
On drivers	244,000	256,000	228,000	252,000	236,000	257,000	240,000
Per driving axle	61,000	64,000	57,000	63,000	59,000	64,250	60,000
On idler axle	.....	.....	52,000	.....	53,000	.....	54,000
Principal dimensions, ft.-in.:							
Gauge	4-8½	4-8½	4-8½	4-8½	4-8½	4-8½	4-8½
Overall length (inside knuckles)	56-6	56-6	56-6	56-6	56-6	56-6	56-6
Overall width	10-6	10-6	10-6	10-6	10-6	10-6	10-6
Width over cab sheets	10-0	10-0	10-0	10-0	10-0	10-0	10-0
Overall height above rail	15-0	15-0	15-0	15-0	15-0	15-0	15-0
Height over roof	14-3½	14-3½	14-3½	14-3½	14-3½	14-3½	14-3½
Truck wheel base-front	9-4	9-4	9-4	9-4	9-4	9-4	9-4
Truck wheel base-rear	9-4	9-4	15-6	9-4	15-6	9-4	15-6
Total wheel base	43-4	43-4	43-5	43-4	43-5	43-4	43-5
Distance between truck centers	34-0	34-0	31-0	34-0	31-0	34-0	31-0
Wheel diameter, in.	42	42	42	42	42	42	42
Steam generator capacity, lb. per hr.	.....	2,500	4,000	.....	4,000	.....	4,000
Tractive force starting, at 30 per cent adhesion, lb.:	73,200	76,800	68,400	75,600	70,800	77,100	72,000
Fuel oil, gal.	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Lubricating oil, gal.	300	300	300	350	350	400	400
Engine cooling water, gal.	310	310	310	330	330	350	350
Sand, cu. ft.	20	20	20	20	20	20	20
Heating water, gal.	.....	700	1,400	.....	1,400	.....	1,400



The pre-assembled air-brake panel from which any part can be easily removed for servicing

Mounted on the underframe is the fuel tank and fully ventilated battery box assembly with the batteries arranged longitudinally on each side for equal accessibility to each cell. The 1,200-gal. welded steel fuel tank is fitted with a direct-reading sight gage so that overflow can be avoided during filling operations, and with a hydrostatic fuel level indicating gage mounted adjacent to the engine control panel. The underframe is so designed and finished that there are eight permissible lifting points, one at each end of each bolster, and one at each corner of the underframe. The lifting points on the corners of the underframe are located near the outer edge to permit lifting at as near a vertical angle as possible, thus reducing the capacity of the crane required to lift the locomotive.

The superstructure is made up of seven major subassemblies: the nose and cab weldment, two truss weldments forming the sides, the No. 2 end frame, and the three main roof hatches. The nose and cab form an integral unit and are constructed of steel shapes and plates braced and secured to the underframe by welding.

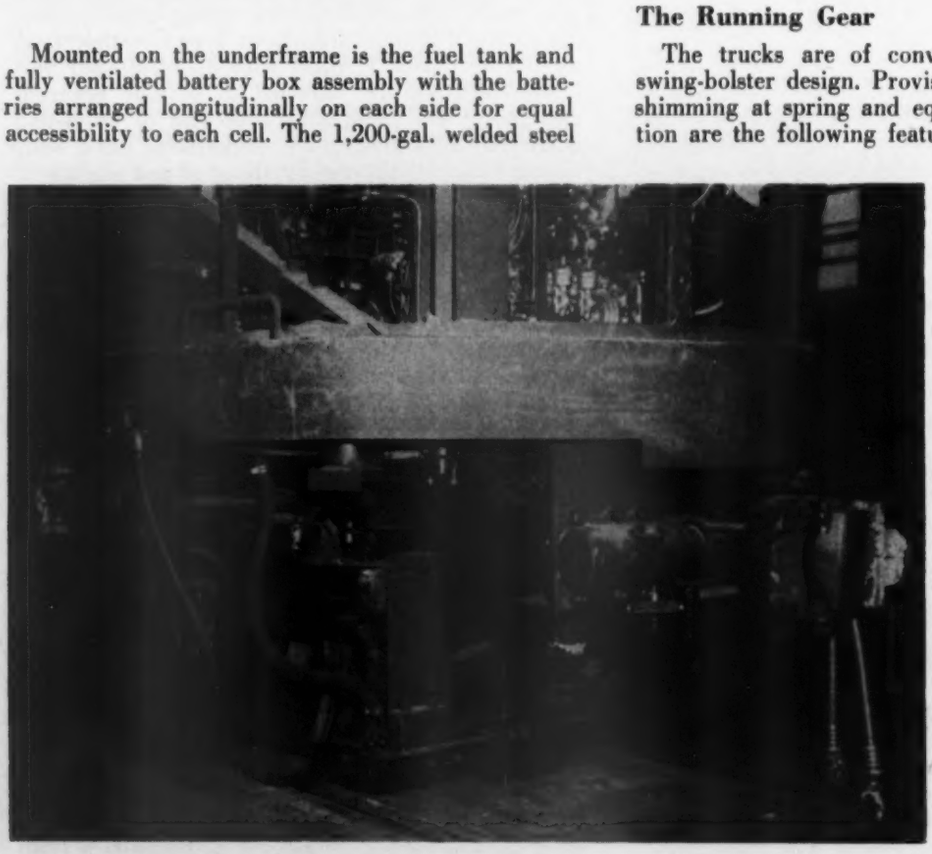
The cab is insulated against noise and heat. The cab heating plant is arranged to recirculate cab air via the nose compartment, fresh air intake being regulated by the engine crew by use of the triangular forward side windows which pivot on a vertical axis.

The nose section is approximately 3 ft. shorter than on previous F.-M. road locomotives. This economy of length, together with unusually large windshield area, affords improved visibility, as well as a reduction in weight.

The side truss top chord is a U-section in which is carried all control and auxiliary locomotive wiring. These ducts are fitted with closing plate sections which may be removed as required.

The Running Gear

The trucks are of conventional drop equalizer, swing-bolster design. Provisions are made for truck shimming at spring and equalizer seats. Of distinction are the following features:



One end of the locomotive showing the coupler-centering device and one of the four jacking pads which permit the locomotive to be lifted at close to a vertical angle

PARTIAL LIST OF MATERIALS AND EQUIPMENT FOR THE FAIRBANKS-MORSE CONSOLIDATION LINE LOCOMOTIVES.

Opposed-piston Diesel Engine; a.c. electrical machinery; cooling fans	Fairbanks, Morse & Co., Chicago
D.C. electrical machinery; d.c. control equipment; a.c. contactors; traction-motor blowers	Westinghouse Electric Corp., Pittsburgh, Pa.
Air-brake equipment; speed-governor control; electro-pneumatic brake; warning horns	Westinghouse Air Brake Co., Wilmerding, Pa.
Wheels; axles; equalizers	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Draft gear	National Malleable & Steel Castings Co., Cleveland, Ohio
Foundation brake rigging; coupler centering device; truck springs	American Steel Foundries, Chicago
Truck frames; bolsters	General Steel Castings Corp., Granite City, Ill.
Composite train-control and cab-signal equipment	Union Switch & Signal Co., Swissvale, Pa.
Speed recorder	Barco Manufacturing Co., Chicago
Journal bearings	Timken Roller Bearing Co., Canton, Ohio
Paint	E. I. duPont de Nemours & Co., Wilmington, Del.
Batteries	Electric Storage Battery Co., Philadelphia, Pa.
Cooling system thermostatic control equipment	Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Shutters, cab heaters and defrosters	Kysor Heater Co., Cadillac, Mich.
Headlight; signal light; class lights; jumpers and receptacles	Pyle-National Co., Chicago
Engine governor	Woodard Governor Co., Rockford, Ill.
Steam generator; steam-line end valves; steam-line connectors; remote boiler control	Vapor Heating Corp., Chicago
Hand brake	National Brake Co., New York
Sanding equipment	Prime Manufacturing Co., Milwaukee, Wis.
Side panels	Met-L-Wood Corp., Chicago
Cab seats	American Seating Co., Grand Rapids, Mich.
Windshield wipers	Sprague Devices, Inc., Michigan City, Ind.
Air filters	Farr Co., Los Angeles, Cal.
Lubricating oil filters	Michiana Products, Inc., Michigan City, Ind.
Lubricating oil strainer elements	Air-Maze Corp., Cleveland, Ohio
Fuel oil filters	Purolator Products, Inc., Newark, N. J.
Fuel oil filters	Wm. Nugent Co., Chicago
Radiators	Yates-American Machinery Co., Beloit, Wis.
Oil-heat exchangers	Ross Heater & Mfg. Co., Buffalo, Wis.
Engine nubber and silencers	Burgess Manning Co., Chicago
Cab insulation	Reynolds Metals Co., Louisville, Ky.
Indicating lights	Dial Light Co. of America, New York
Pressure gauges	Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Flexible coupling	Falk Corporation, Milwaukee, Wis.

1—Adaptability to standard 6½-in. by 12-in. roller-bearing journal housings of four makes.

2—Interchangeability of all parts between the six-wheel and the four-wheel trucks except the frames, bolsters, equalizers and swing hangers.

3—Renewable thrust wear plates which hold all brake hangers in accurate alinement with the wheels, thus eliminating tie rods and overcoming the absence of any such provisions for the inside brake hangers on drivers.

4—Optional foundation brake-rigging lever ratios ranging from 6.1 to 7.64.

5—Brake rigging arranged for use of automatic slack adjusters on the four-wheel power truck.

Each 2,400-hp. unit is powered by an F.-M. 12-cylinder opposed-piston engine rated 2,400 hp. for traction at 850 r.p.m. This is the most powerful single Diesel engine installed in locomotives. On the basis of brake horsepower for traction per cylinder, this engine rating is equivalent to the established ratings of other opposed-piston engines used throughout the entire line of F.-M. Diesel-electric.

The engine cooling system includes four fans powered by Fairbanks-Morse axial-air-gap a.c. motors. Fan motors and shutter opening are automatically controlled. The lubricating-oil filtering, cooling and straining systems are in accordance with the requirements of the engine and utilize replaceable elements. Engine load and speed are automatically regulated by an electro-hydraulic governor in response to signals from the engineman's throttle or master controller. Incorporated in the governor are a low lubricating-oil pressure protection device and a load regulating rheostat. The latter device is graduated in its operation so that higher lubricating oil pressures are required to permit the engine to operate in the higher notches. If the oil pressure drops below the required minimum for the notch in which the engine is being operated, the alarm shutdown stops the engine. The alarm is indicated by a bell in all units and by an amber light on the engine control panel of the unit affected.

The main generators and traction motors are the latest Westinghouse Electric Corporation design. The main generator is self-ventilated with the commutator end supported by a roller bearing. The traction motors are supported by sleeve bearings on the driving axles and by spring-loaded nose supports. The motor armature shafts have roller bearings. The two pairs of traction motors are permanently connected in parallel, with the motors within each pair in series. The traction-motor field shunting events are automatically controlled. A selector switch in the control equipment cabinet serves to isolate either group of series-connected traction motors and reduce generator output.

A 25-kw. auxiliary generator provides ample capacity for all combinations of load demand from steam generators, train control, electro-pneumatic air-brake control, signal headlights and other appurtenances.

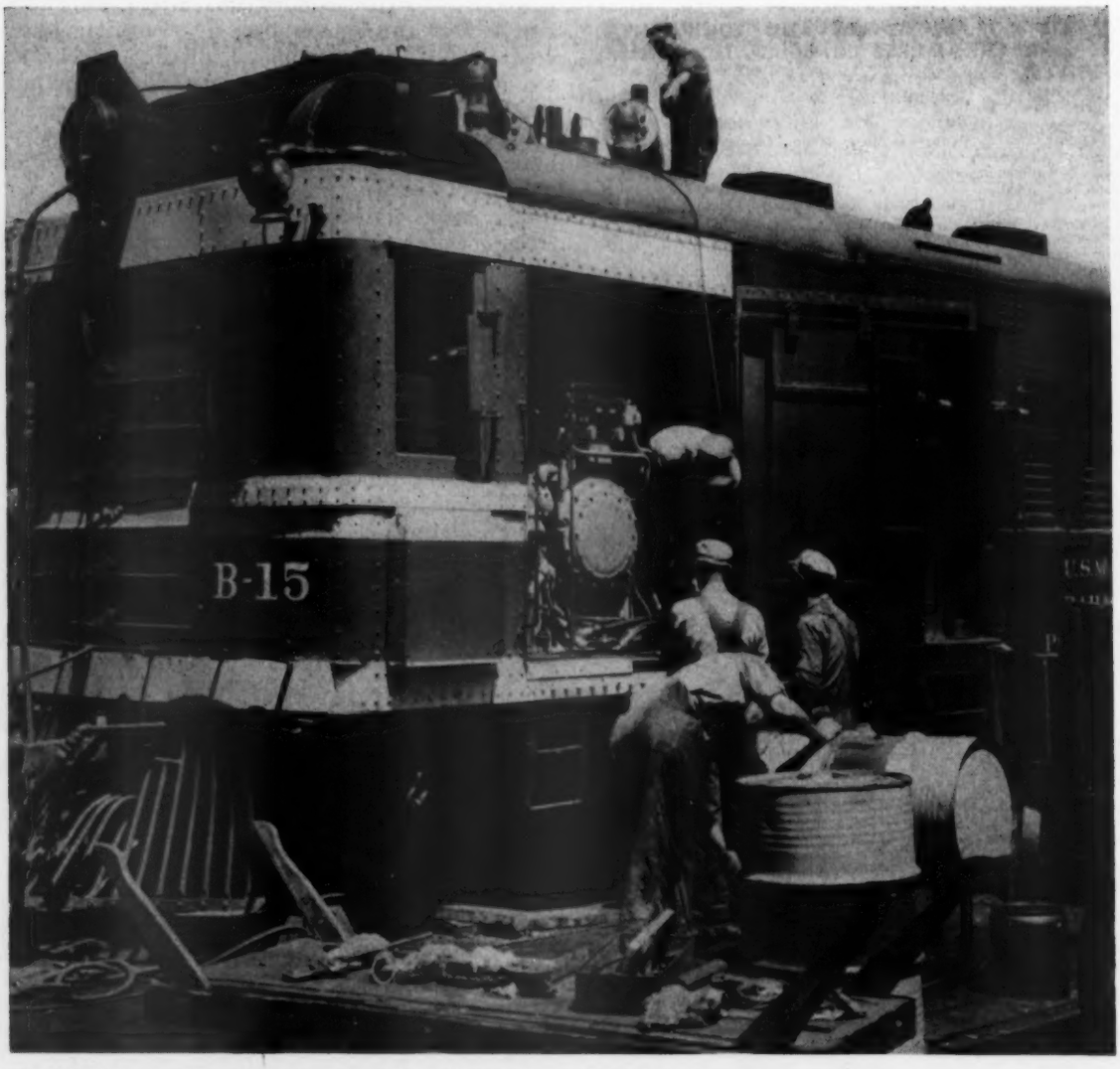
Traction-motor blowers are powered by F.-M. axial-air-gap a.c. motors. These motors are connected to an F.-M. alternator through a multiple control switch so arranged that normal blower speed is doubled for improved traction-motor cooling during dynamic-brake operation.

The dynamic breaking resistors and blower can dissipate energy equivalent to the engine output at the rail of the 2,400-hp. units. When this same dynamic braking unit is used with the 1,600-hp. engine, the energy dissipation capacity is 50 per cent greater than the engine output at the rail.

Schedule 24RL air brake equipment is used throughout, incorporating the "deadman" safety control, locomotive overspeed control with suppression features, electro-pneumatic straight air brakes and speed governor control.

The 56,000-cu.-in. main reservoir capacity is provided in two equal reservoirs. Aftercooling radiators consist of five parallel finned tubes totaling 27½ lineal feet connected ahead of the No. 1 main reservoir and an identical assembly connected between the No. 1 and No. 2 reservoirs. All connections to the main-reservoir supply are after the No. 2 reservoir. The entire main-reservoir system is mounted under the raised cab floor in a compartment subject to outside ambient temperature and sealed from other parts of the locomotive.

(*Continued on page 321*)



The Northern Pacific motor car recently equipped with a Diesel engine, showing the two exhaust mufflers on the top of the car

Gas-Electric Car Converted to Diesel

THE Northern Pacific's Como shop at St. Paul, Minn., has completed the installation of a 275-brake-horsepower Diesel engine in a motor car formerly powered by a gasoline engine and generator. The installation is the first in a series of rail car conversions using the Caterpillar Tractor Company's new D375 V8 Diesel engine. The motor car will operate nine hours daily on a 250-mile round trip schedule between Mott and Mandan, N. D. A feature of the Diesel engine is a pan so designed that the same base supports both the engine and the generator.

The plan is of built-up welded construction and has a four-point suspension with 48½ in. wide legs, where the generator bearing support rests. The generator-support end is sufficiently higher than the engine-support end to permit direct mounting of both pieces of equipment with the crankshaft in alignment with the generator. The integral construction of the pan for supporting both the engine and the generator reduces the tendency for the generator to get out of line from movement of the car. What slight misalignments may occur under operating conditions are com-

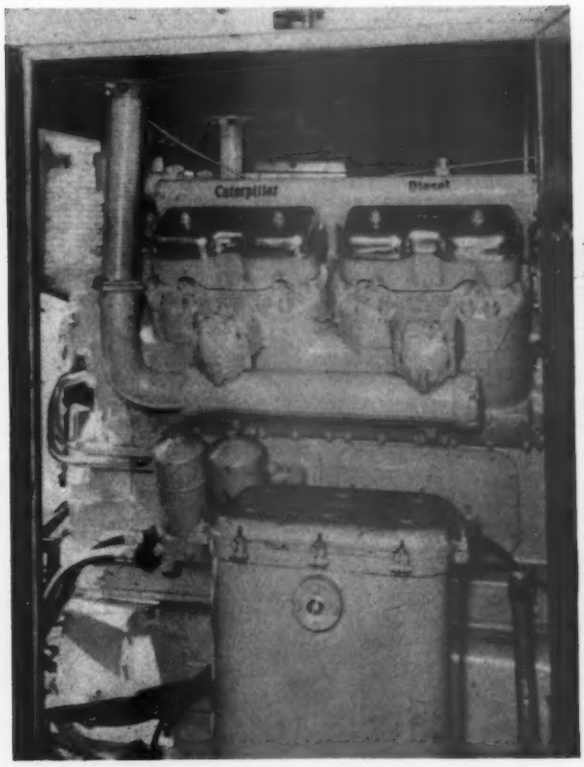
pensated for by the engine-generator flexible coupling.

No modifications were necessary to install the D375 in the car power space. The wall-mounted radiator and motor-driven fan that previously cooled the replaced gasoline engine were left intact for use as the cooling arrangement for the D375's jacket water and lubricating oil. Existing auxiliaries, such as controls, were retained. Connections to the auxiliaries, such as piping, linkage, etc., were changed in some cases.

The original gasoline engine and direct-driven single-bearing generator were removed from the motor car and the generator was uncoupled from the engine. The generator (GE type DT507-B-2, direct current, 485 volts, 420 amp., 625 maximum amp.) was then shipped to the Caterpillar factory for mounting to the engine and pan. The flywheel adapter plate and flexible coupling (size 625SS) connecting the generator to the new engine were furnished by the Thomas Flexible Coupling Company, Warren, Pa.

The engine was built to operate with a reverse rotation, clockwise when facing the flywheel. The exhaust elbows were assembled at the front ends of the exhaust manifolds instead of at the rear. Attachments for the engine include: overspeed governor group, safety alarm switch, flexible fuel lines, flexible exhaust pipes (Maxim MU type mufflers) electric starting motor and generator. Io engine charging generator was required with this installation as the starting batteries are charged from the main generator's exciter.

The engine rating is 275 b.h.p. at 1050 r.p.m. The high idling speed is 1,112 r.p.m. and low idling speed is 410 r.p.m. The total weight of the engine, generator, coupling, base extension and attachments is 12,555 lb.



The exhaust elbows were assembled at the front ends of the manifolds instead of at the rear

The pan for the D375 engine has legs 48 ½ in. wide where the generator bearing support rests, which are high enough to level off with the crankshaft

F-M "Consolidation Line" Locomotives

(*Continued from page 319*)

The engine, main generator, traction-motor blowers and air compressor are supplied intake air from the engine-room space which, in turn, is supplied through impingement-type air filter panels mounted in the No. 1 and No. 2 hatch assemblies. Engine intake air is again passed through identical filter panels before entering the positive displacement blower.

Sanding equipment is arranged to deliver sand ahead of the leading wheels of each truck in either direction of operation. The appropriate sand traps on both units are controlled by the manual or automatic operation of sanders on each unit.

The engineman's throttle, reverser, dynamic brake controller, air-brake valves, sanders and bell-ringer valves, warning-horn-valve pull cords, loadmeter, air-brake gages, miscellaneous control switches and indicating lights are conveniently arranged from the standpoint of operation as well as accessibility for maintenance.

Two good practices in shop layout are illustrated above—Making the concrete posts tee-shaped keeps all posts 8 ft. away from the nearest track and leaves good working space for men and trucks—The rail supports are single posts to permit access to the pits at any point as well as light and ventilation

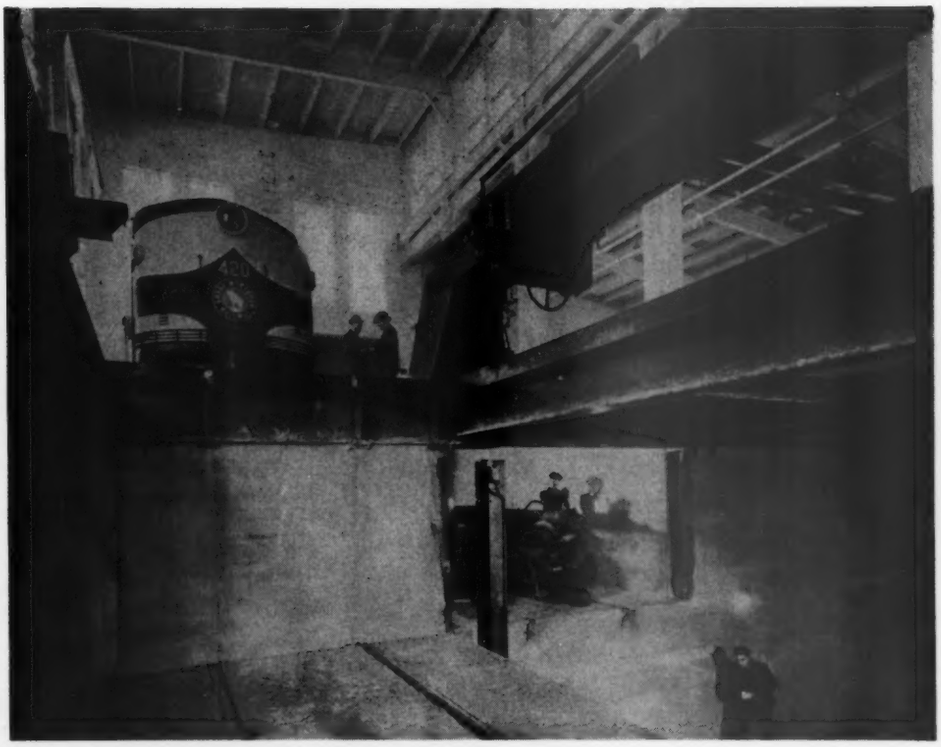
Design Trends in Diesel Shops*

BECAUSE the inherent characteristics of the Diesel-electric locomotive are so different from those of the steam locomotives, a careful study is required when new locomotive shops are being considered. The planning for such Diesel shops should be started as soon as or before the first Diesels are ordered. Railroads cannot afford mistakes in selecting the location or design of new Diesel facilities, and every cost reducing possibility should be investigated during the planning period.

First the location for a new shop must be given careful thought. Perhaps existing steam servicing shops are in the right spot to also handle Diesels, but usually the rearrangement of locomotive assignments and shopping schedules caused by the substitution of Diesel for steam power also requires the relocation of the shops to service and maintain the new power. Analysis of the changed conditions sometimes shows that a terminal which is kept busy when steam power is in service should be entirely abandoned after the steam has been completely replaced by Diesels. Since a displacement of steam by Diesels is usually a gradual operation, there is a period during which both types of power must be maintained.

Existing steam shops and enginehouses are properly located and equipped for handling steam power and will need to be maintained, although on a reducing scale, as long as steam locomotives are in service. Such a necessity should not influence the planning of new facilities for handling Diesels. If too much consideration is given to the fact that the road is already supplied with steam servicing shops and equipment, full advantage may not be taken of the

*Abstract of a paper presented at the March meeting of the Southern & Southwestern Railway Club by A. W. Skinner, Whiting Corporation, and R. H. Herman, engineer of shops and equipment, Southern Railway System.

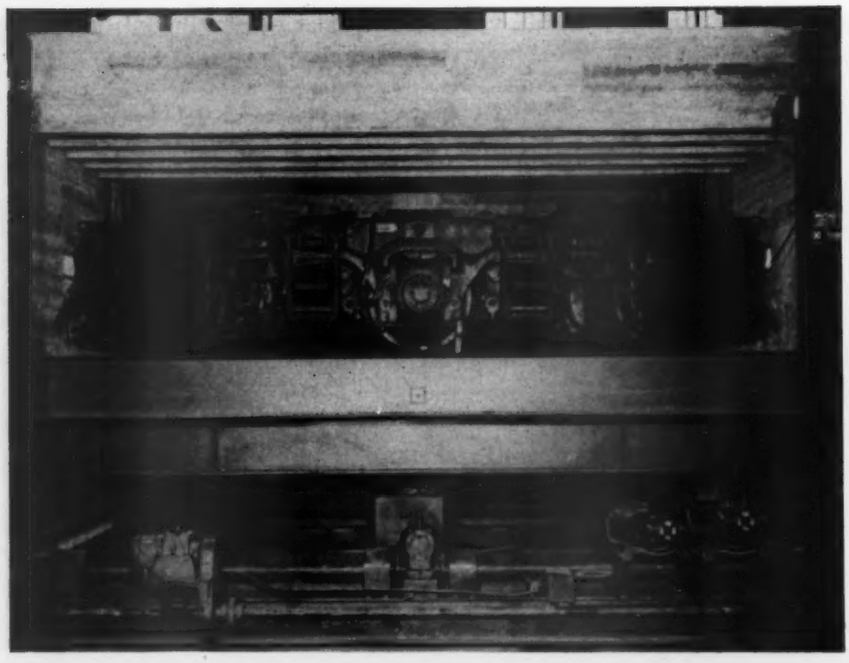


How a handicap was turned into an asset —The service tracks were too close together to permit releasing a truck between them, so a tunnel was built to serve not only as a release track but to provide additional storage space

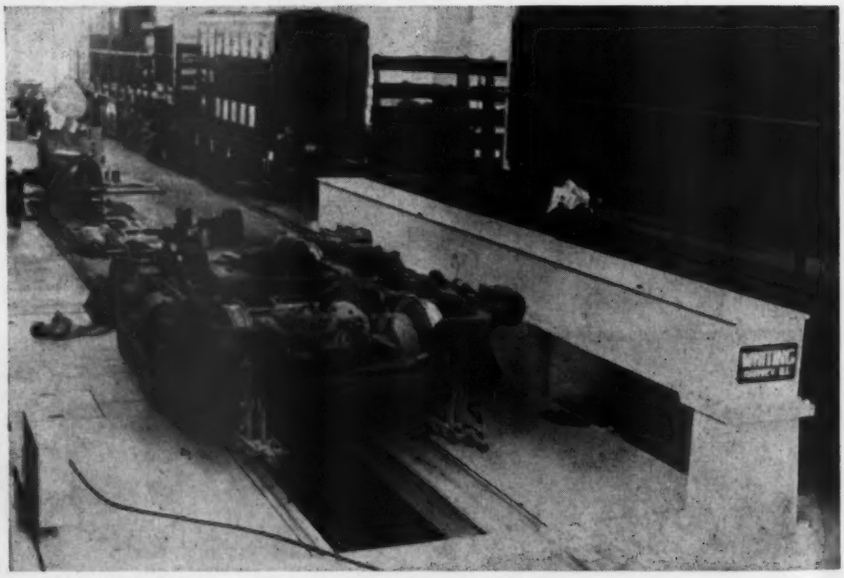
operating efficiencies possible with Diesels when steam is displaced. A shop or enginehouse which may be operating efficiently as long as it services steam power only, may, because of its design or location, prove extremely wasteful if used for servicing Diesels. Anything which keeps a Diesel out of useful, productive service unnecessarily must be considered wasteful.

There will come a time when it becomes economically impossible to maintain two sets of maintenance facilities, one for steam and one for Diesel power. When that time comes, perhaps the best move is to scrap all remaining steam locomotives as well as supporting servicing, maintenance and repair facilities as rapidly as possible and replace the steam locomotives with Diesel immediately.

By having the crane run crosswise instead of lengthwise with the shop all tracks can be served—The crane pictured above has a 40-ft. span and operates over six tracks, the machine area, and the engine repair area



Very little clearance is available between the ends of a six-wheel truck and the walls of a 23-ft. pit; therefore, a minimum top length of 23½ ft. is recommended where six-wheel trucks are handled



The truck on the release track table has been dropped from the locomotive at the right, and transferred through a pit only 5 ft. deep.

Scrapping steam locomotives and their maintenance facilities does not necessarily mean junking. Neither does it mean that the shop equipment is not still valuable. Most roads will find they already have enough machine tools of most types, although additional equipment will probably be needed for the electrical repair room. Many new uses can be found for some of the other equipment. Tenders and tanks may serve in the hauling, reclaiming and storing of lubricating and fuel oil. In the extensive piping required in a Diesel shop the pipe or fittings salvaged from water handling and treating plants will come in handy. Even boiler flues may prove useful.

If, before the final steam scrapping period arrives, a road has completed its long-range planning and has provided properly located, designed and equipped Diesel shops, that road will be in an enviable position as far as its ability to operate its Diesels at maximum efficiency is concerned. Such a final result might easily mean the difference between financial success or failure on many roads in difficult days.

Fortunate is any road which has sufficient space at the right spot to provide a Diesel shop which is both large enough and in the proper location. It is generally found that existing tracks, buildings, turntables, transfer tables and other fixed parts obstruct the site and its approaches. There is a natural reluctance to remove or scrap many of these interfering objects which seem to have many years of useful life remaining but nothing should be allowed to obscure the main plan.

Some important features of this main plan are:

1—The shop should be large enough for several years use without needing any important additions.

2—When increasing demands on the servicing facilities finally do force the enlargement of the shop, such additions should fit into the original plan without impairing the shop's efficiency. The first plan should try to envisage all necessary future expansion.

3—All locomotive movements to and from the shop for progressive maintenance should as far as possible be under load. The high earning power as well as the large investment in a Diesel makes it imperative to eliminate all dead-heading or use of train crews for the mere purpose of moving a locomotive to and from a shop. Since the number of Diesels on any road is less than the number of steam locomotives required to do the same work, each locomotive comprises a greater percentage of the total. Consequently more attention should be given to the problem of keeping every locomotive at work every possible minute. Track changes may be necessary to permit rapid, uninterrupted movements to and from the shop.

4—The shop should be completely equipped with tools designed to permit every locomotive being returned to service as expeditiously as possible.

Proper locations having been selected, the shop design should be determined. No two Diesel shops operate under exactly the same conditions in regard to number and type of locomotives handled, traffic schedules to be maintained, classes of inspection, maintenance and repair work to be done as well as many other variable features. Consequently no two shops are or should be exact duplicates and considerable study should be given the design for each location. In making such studies, railroads should freely consult the service departments of locomotive builders as well as manufacturers who build the specialized equipment required for modern Diesel shops. These builders and manufacturers have learned a lot about Diesel shop design through their close contacts with all the railroads which have built shops in the past few years. Any railroad planning a new shop should make use of their experience.

Most modern Diesel shops contain running repair and inspection tracks having adjacent deck-level platforms. The working areas around the tracks have depressed floors to provide headroom for men inspecting trucks and their auxiliary parts, filling fuel tanks, etc. The supports for deck-level platforms in a well designed shop are arranged to permit free passage of fork, platform or lift trucks carrying brake shoes or other parts which must be delivered on the lower level.

The deck-level platforms should be at the right height to permit easy access to locomotives. In addition there is an area or areas where the shop floor is at the top of the rail. Parts of such areas are in the main portions of the shop, and parts are in separate rooms. Flush floor areas which are not used for actual repair work, or for storage of parts required for the repair work performed on that level, should be kept to a minimum since such excess areas constitute a waste of valuable space. As far as possible, parts rooms, cleaning rooms, etc., should be kept on the same levels as the working areas where such parts are used. Such a design reduces steps, stairs and ramps to a minimum which is desirable since such structural features are handicaps to the free flow of men and materials, take up a great deal of otherwise usable space and are frequently dangerous to personnel.

A wide range of equipment must be studied before selecting the items to be included in a new shop. Some of the more important material handling machines are overhead traveling cranes, fork trucks, crane trucks, platform trucks and monorail systems.

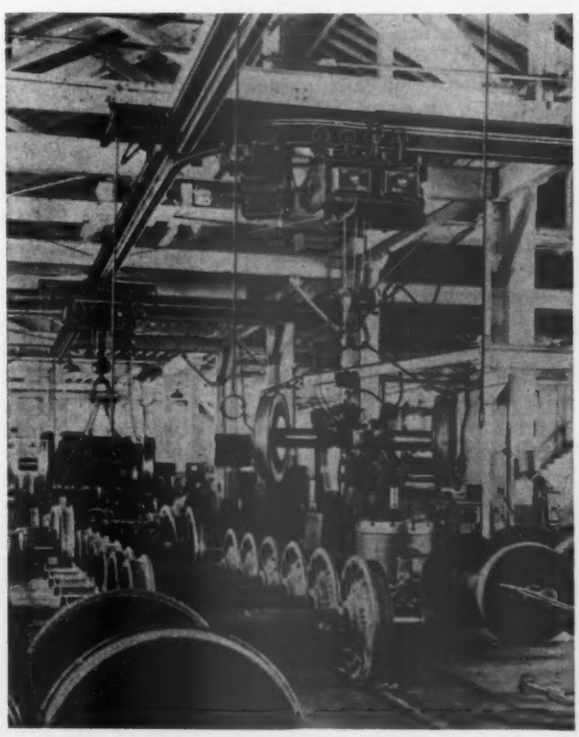
Because of their flexibility, compactness, lightness and small cost, monorail systems should be given careful consideration. By means of interlocks and switches monorail trolleys can be routed through all parts of the shop where loads must be handled or diverted to traveling bridges to form overhead cranes.

One or more drop tables, with associated equipment such as properly designed tops and body supports are a necessity in any Diesel shop. A drop table is by far the quickest and safest tool for changing wheels and trucks and can also be used for changing springs and draft gears.

Crossover bridges to permit passage from track to track on deck-level platforms as well as on the depressed floor are very convenient and time-saving.

In addition there is a long list of other equipment required for the electric repair room, filter cleaning room, air brake room, oil testing, handling and storage equipment, water systems, battery changing equipment, injector testing facilities and store rooms.

By means of interlocks with switches hoists can be transferred between various monorail lengths and between the monorail and the traveling crane to serve nearly every point in either a Diesel wheel or a car wheel shop



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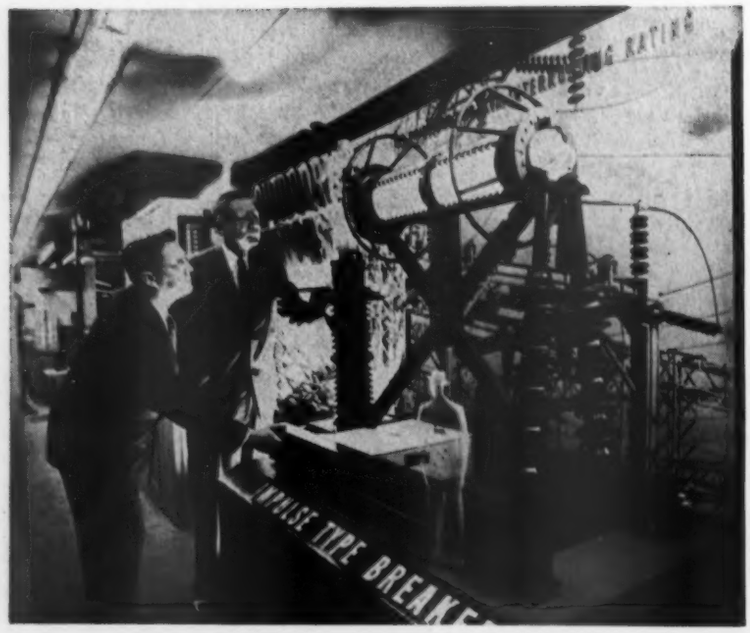


H. V. Erben (right), vice-president and general manager, Apparatus Department, and J. S. Smith, manager of the Department's advertising and sales promotion divisions, operate a model of a huge 230-kv. impulse breaker in the Power Generation section—Transparent sections and colored lights demonstrate how 10 million k.v.a. can be interrupted in less than five-hundredths of a second.

THE "More Power to America" Special is a project of the General Electric Company's Apparatus Department and is believed to represent the first time that all apparatus for producing, distributing, and utilizing electric power has been displayed in a single series of related exhibits. It is also believed to be the first display of this magnitude which has been completely installed in a train. Over 2,000 products, processes and techniques are displayed in eight of the ten cars which make up the train, many of them in operating exhibits.

The train was launched on a nation-wide tour by the General Electric Company at New York, after it was inspected during several days beginning on April 26 by invited representatives of electric utilities and manufacturing industries, by transportation officials, by representatives of the armed services, and by municipal officials. It will visit approximately 150 industrial centers during 1950 and 1951 where it will be inspected, on invitation, by parties similar to those who saw it at New York. It will not be open to the general public.

Speaking at a press luncheon at the Hotel Biltmore on April 24, Henry V. Erben, vice-president and general manager, Apparatus Department, said that General Electric has put almost half a billion dollars in new plants and in modernization of old facilities. "We are spending our dollars as evidence of our faith in the future and through this train we hope to encourage others to do the same," he declared. Chester H. Lang, vice-president in charge of apparatus sales, said that the train is a deliberate commercial adventure. "We must again turn the minds of our people," he said, "to the creation of wealth, to the modernization of our industrial machine, to the building of a more productive America."

J. Stanford Smith, manager of the Apparatus Department's advertising and sales promotion division, referred to the train as "a display kit" of General Electric apparatus salesmen. "To haul it around," he said, "we've turned to the only transportation agency in the world capable of handling such an assignment —the American railroads. Here are steel tracks, a well-established network of paths to all the customers we want to reach. In passing, we note that the 'More Power to America' special is General Electric's vote of confidence in the future of American railroads."

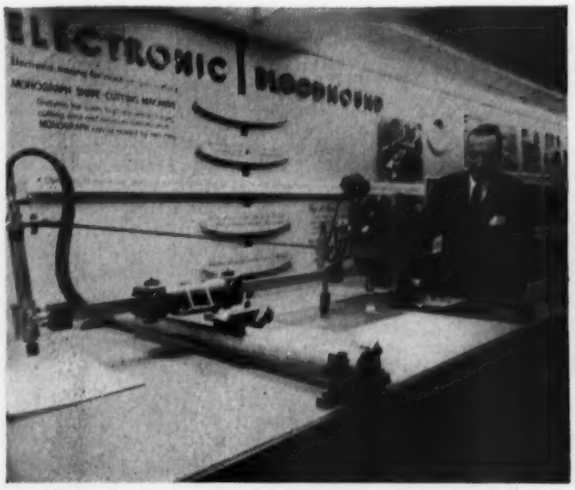
The exhibits in the eight cars have been grouped in 11 sections. These are power generation, distribution, and transmission; motors and control devices; materials handling, which includes the possibilities of saving through the use of Diesel locomotives for industrial railroading; welding; electric heating; renewal parts and service shops; industrial lighting; components for industry; measurements; civic improvements section, and national security. These sections include exhibits of apparatus, some operating, as well as wall charts and other bases of visualization of economic possibilities.

The train is being hauled by a 4,500-hp., two-unit American Locomotive-General Electric Diesel-electric locomotive, itself one of the exhibits. The cars were built by the Pullman-Standard Car Manufacturing Company at Worcester, Mass. They are built to Chicago, Rock Island & Pacific specifications, to which road they will be sold on completion of the tour. One car is fitted with checking and wardrobe facilities, and a second is furnished as an office and reception area.

The Exhibit Cars

The cars are of Pullman-Standard welded truss type construction, the body frames and underframes of which are of low-alloy high-strength steel, with stainless-steel side and end sheathing and outside roof sheets. Fiberglas insulation is applied to the sides, ends, and roofs. The cars were delivered without top

Electric Company 10-Car Power "Display Kit"



Left: K. R. Van Tassel, manager of the Apparatus Control Division, operating a detection unit which automatically follows a pattern located beneath it and reproduces through electronic signal processes the identical pattern at the location on the left—Right: N. M. DuChemin, assistant general manager, Apparatus Department, looks over a display of watt-hour meters in the Measurements section.—Hundreds of different precise instruments designed to perform scores of valuable services throughout industry, aboard ships, trains, and aircraft, and in laboratories and research centers are arrayed in this section.

floors in order that reinforcing could be applied as needed for the attachment of the exhibits. In arranging these care was taken to maintain a suitable center of gravity of a car as a whole and attachments were designed for adequate shock resistance.

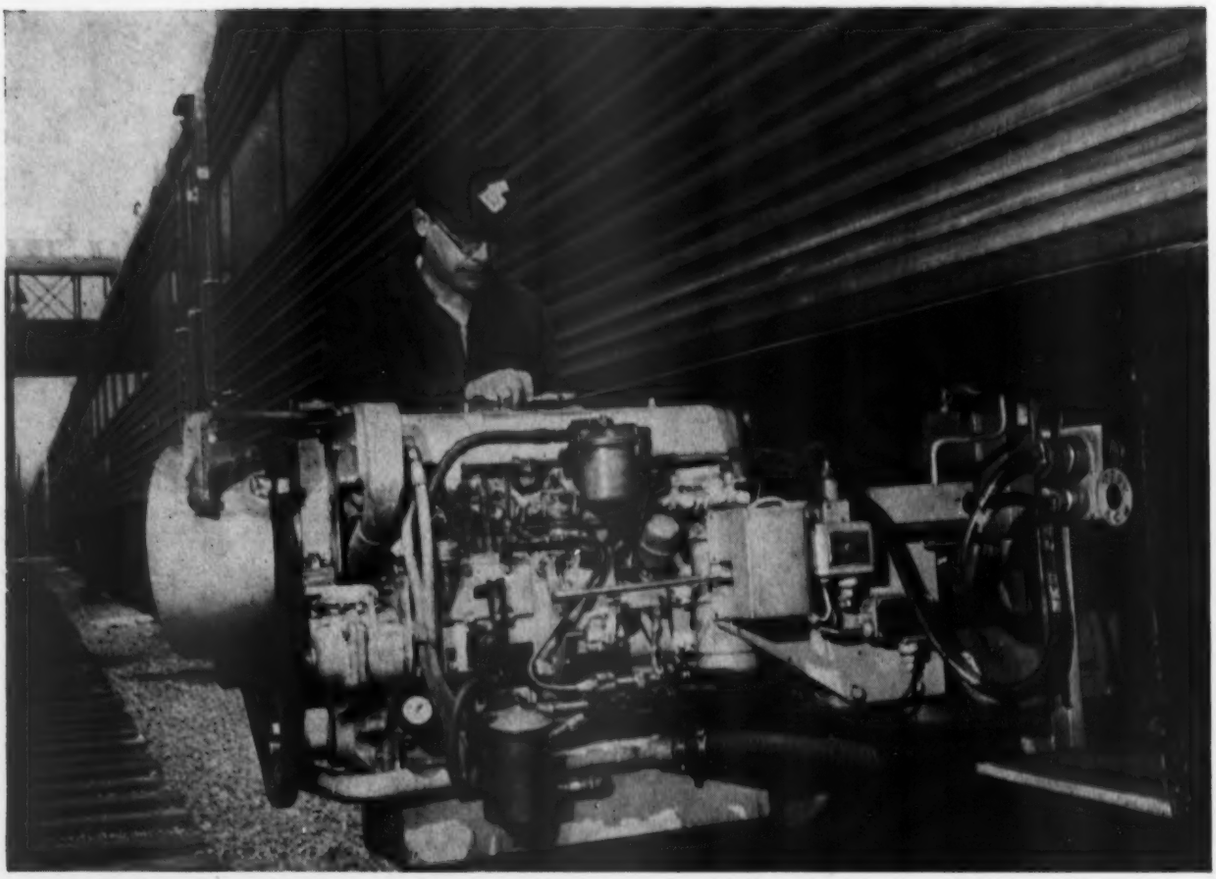
The windows are Libbey-Owens-Ford Thermopane double-glazed sealed units with ¼-in. laminated inner panes and ¼-in. heat-resisting outside panes. Inasmuch as the exhibits are arranged along the sides of the cars, the insides of the windows are given an opaque coating which will be removed when the exhibition tour is completed. The window sills are of Texolite, a new G.E. laminated plastic application.

Mounted under each car is a Diesel-engine-driven a.c. power plant rated at 30 kw. which provides power for lighting, air conditioning, most of the train heating, and for the numerous operating exhibits on board. It has sufficient clearance to allow unrestricted movement on any American railroad. Maintenance is facilitated by a hinged mounting arrangement which permits the power plant to be swung from its housing and out from beneath the car. Each plant consists of a four-cycle Buda Diesel engine and an alternator which generates 220-volt, 3-phase, 60-cycle power. The exciter is an ultra high-speed amplidyne generator. Thermostatic control of the motor-driven radiator blower maintains the engine water temperature between desired limits.

The power plants have been designed to operate in parallel so that the entire train is train-lined to assure maximum reliability. The alternators are especially designed to eliminate the need for synchronizing equipment to parallel the sets. Four additional engine-generator units are installed in a section of the baggage-dormitory car accompanying the train to supply additional power needed for some exhibits.

The total weight of the Diesel-driven equipment is said to be less than that of the conventional axle-driven generator with its attendant batteries, cable, control and drive unit. The chief advantage is the elimination of the load on the locomotive produced by axle-driven generators. There is the supply of potential heat both in the engine jacket water and engine exhaust in addition to about 20 kw. of electric heat. With suitable car heating equipment a recovery of about 18 kw. of exhaust heat and 25 kw. of waste heat from the jacket water is possible, thereby making about 214,000 B.t.u. total heat available for heating a car.

The heating equipment on all cars, except the office-reception car, includes Vapor zone-control floor-heat radiators along the sides and G.E. Calrod electric heaters in the ceiling. These are supplied with 18 kw. of electric heat which minimizes the need for the use of steam. It is anticipated that little, if any, steam heat will be required throughout the tour.



A workman inspects General Electric Diesel-driven under-car power plant on one of the exhibit cars

PARTIAL LIST OF MATERIALS AND EQUIPMENT USED IN THE CONSTRUCTION OF THE CARS FOR THE GENERAL ELECTRIC "MORE POWER TO AMERICA" SPECIAL

Truck frames	General Steel Castings Corp., Granite City, Ill.
Truck springs	American Locomotive Co., Railway Steel Spring Div., New York
Wheels, axles	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Roller bearings and boxes	(3) Fafnir-Waugh Bearings Div., Waugh Equipment Co., New York (3) Hyatt Bearings Div., General Motors Corp., Harrison, N. J. (4) Timken Roller Bearing Co., Canton, Ohio
Buffer and draft gear	Waugh Equipment Co., New York
Couplers and uncoupling device	Symington-Gould Corp., Depew, N. Y.
Yokes	National Malleable & Steel Castings Co., Cleveland, Ohio
Swing hanger pins and bushings	Ex-Cell-O Corp., Detroit, Mich.
Side bearings	American Steel Foundries, Chicago
Shock absorbers	Houdaille-Hershey Corp., Houde Engineering Div., Buffalo, N. Y.
Upper buffer springs	Standard Railway Equipment Mfg. Co., Hammond, Ind.
Locking center pins	W. H. Miner, Inc., Chicago
Fabreeka pads at center plate, body side bearing, top equalizer coil spring, journal box, center stem sleeves, and side stem wear plates; control-, relay-, and magnet-valve mounting washers	Fabreeka Products Co., Boston, Mass.
Spline bushings	Hyatt Bearings Div., General Motors Corp., Harrison, N. J.
Bolster stop	United States Rubber Co., New York
Air brakes; water raising equipment	Westinghouse Air Brake Co., Wilmerding, Pa.
Hand brakes	National Brake Co., New York
Clasp brakes	American Steel Foundries, Chicago
Brake shoes	American Brake Shoe Co., New York
Undercar power plant; transformer; switchboards; cable and wire; lamps	General Electric Co., Schenectady, N. Y.
Batteries	Electric Storage Battery Co., Philadelphia, Pa.
Standby and battery-charging receptacles	Pyle-National Co., Chicago
Lighting fixtures	Luminator, Inc., Chicago
Air-conditioning equipment	Safety Car Heating & Lighting Co., New York
Air grills	Tuttle & Bailly, Inc., New Britain, Conn.
Multi-Vent ceiling panels	Pyle-National Co., Chicago
Heat and train-line specialties	Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. Vapor Heating Corp., Chicago
Steam connectors	Barco Manufacturing Co., Chicago
Pipe covering	Johns-Manville, New York
Train-line connectors	Pyle-National Co., Chicago
Metal-faced plywood	Met-L-Wood Corp., Chicago
Insulation	Gustin-Bacon Mfg. Co., Kansas City, Mo.
Mirror glass	Alto Manufacturing Co., Chicago
End door operators	National Pneumatic Co., Rahway, N. J.
Window units	Libbey-Owens-Ford Glass Co., Toledo, Ohio
Vestibule curtains	Adams & Westlake Co., Chicago
End door locks	Dayton Manufacturing Co., Dayton, Ohio
Window sills	General Electric Co., Schenectady, N. Y.
Water tanks	Scaife Co., Oakmont, Pa.
Washstands; dental lavatories	Crane Co., Chicago
Hoppers	Duner Co., Chicago
Soap dispensers; disinfectants	West Disinfecting Co., Long Island City, N. Y.
Paper holders and cabinets	International Cellucotton Products Co., Chicago Scott Paper Co., Chester, Pa.
Water coolers	General Electric Co., Schenectady, N. Y.
Water filters	Tested Appliance Co., Chicago
Drinking-cup dispensers	U. S. Envelope Co., Worcester, Mass.
Fire extinguishers	Pyrene Manufacturing Co., Newark, N. J.

A supersensitive electronic system of controls automatically regulates the temperature and humidity in the combination office and reception car. Developed by the Minneapolis-Honeywell Regulator Company, the system is designed to adjust to one-tenth of one degree of temperature change and one-half of one per cent change in humidity. Changeover from heating to air conditioning is automatic, providing comfortable temperature regardless of outside conditions.

Electronic thermostats installed against the outside skin of the coach detect changes in outdoor conditions and make compensating adjustments inside before the change is felt within. Inside the car the system employs the principle of radiant heating from side-wall panels, controlled by a window thermostat which adjusts for the sun. This heating works in unison with an overhead duct system supplying warm air. A thermostat controls the heating valve on the overhead coil supplying sufficient heat to maintain car temperatures.

The sensing element in the system consists of temperature-sensitive resistance wire, which is wound on an open plastic spool. The wire is treated with a chemical compound sensitive to moisture, and it reacts to moisture change in controlling humidity.

The electronic system is operated by a single on-off switch. This relieves the train personnel of any responsibility for temperature adjustments.

The Safety air-conditioning system includes an a.c. motor-driven compressor, with full-flooded evaporative type condensers. The motors operate at constant speed. The cooling is modulated by automatically unloading the compressor cylinders in sequence, thereby providing 25, 50, 75 or 100 per cent of full capacity as is needed.

The cars are carried on four-wheel Commonwealth trucks with alloy cast-steel frames and bolsters, all-coil springs, bolster anchors and shock absorbers. Journals are 5½ in. by 10 in. Side bearings are Drews Evertite Type F. The trucks on four cars are fitted with Timken roller bearings; on three cars with Fafnir-Waugh bearings and on three, with Hyatt.

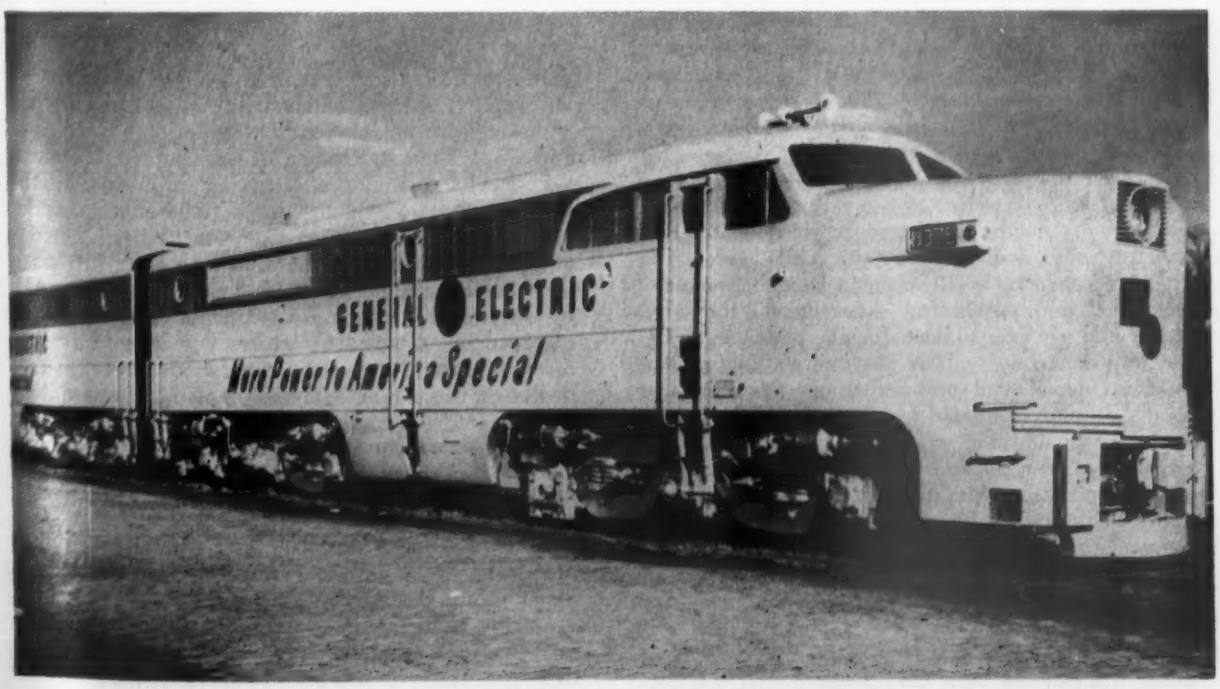
Air brakes are Westinghouse HSC type with electro-pneumatic feature and speed-governor control. Truck clasp brakes are Simplex unit cylinder type. The draft gears are Waughmat. Couplers are Symington-Gould Type H-81 tight lock, with Type H-15A rotary lock lifters and National Malleable & Steel Castings Type Y-65 yokes.

The Locomotive

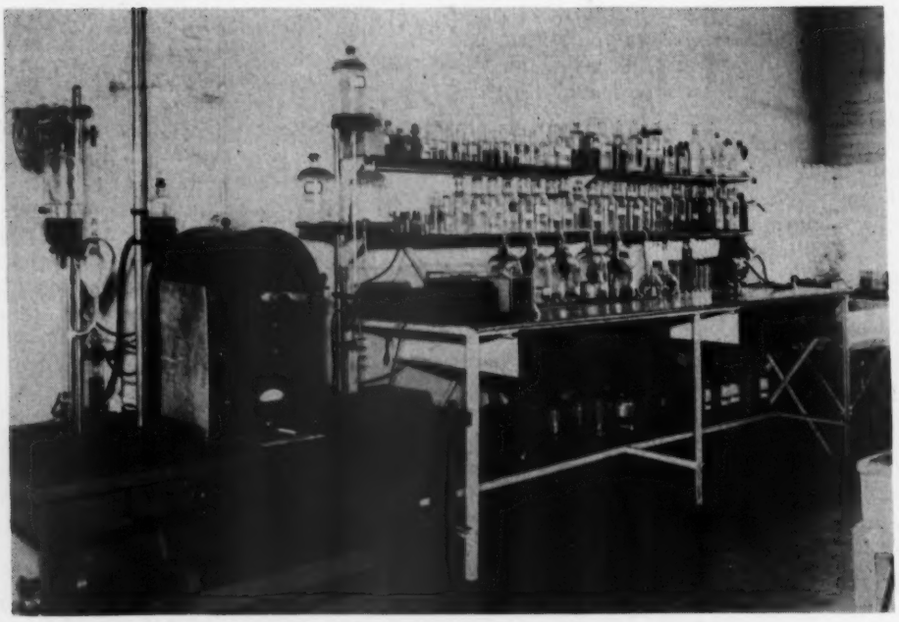
Each of the two units of the 4,500 hp. Diesel-electric road locomotive which hauls the train is powered with a 16-cylinder V-type turbosupercharged Diesel engine rated at 2,250 hp. Generators, motors and control are G.E. The increase in rating from 2,000 to 2,250 hp. per locomotive unit has been effected by an increase in air pressure from the supercharger and an increase in engine speed. Electrical equipment has also been revised in accordance with this change in rating. The axles of the six-wheel trucks have Timken roller bearings.

On the locomotive units are Vapor-Clarkson steam generators with a combined total capacity of 3,000 lb. of steam per hour. The locomotive brakes are Westinghouse 24 RL with speed governor, electro-pneumatic straight-air, and 3CDB compressor. The locomotive is also equipped with dynamic brakes. There is a complete accoutrement of automatic train control and cab signal equipment so that it can operate over any main line in the United States.

The locomotive weighs 315 tons. It is 129 ft. 2 in. long and has an overall wheel base of 99 ft. 4 in. The two units carry 2,400 gal. of fuel oil, 460 gal. of lubricating oil, and 3,200 gal. of water for steam heat.



How Railway Materials Are Tested



Section of C. & N.W. general analytical laboratory at Chicago

By R. E. Coughlan†

CURIOSITY is a great incentive to investigation, a sure way to attract large crowds and sometimes to invite trouble. It is a typical natural characteristic of the American people. Scientists have sometimes glorified this curiosity by calling it research or research development, but it is still "why," or "what is it made out of," or "what makes it tick."

Research is inflicted on railway supply companies by railroads in the form of the railroad test department, usually headed by an engineer of tests. This comparatively small department, while necessarily part of a railroad, is often the referee between the mechanical and purchasing departments, the engineering and mechanical departments, or the legal and operating department. It is also the wailing wall of the claim department and sometimes the source of expert testimony required by the railroad in certain law suits. In addition, it is usually the liaison department between the railroads and the various government and state regulating bodies in matters pertaining to public health and sanitation under interstate traffic regulations.

The employees of the testing department are all technically trained men, many of them with a master or doctor's degree in chemistry, metallurgy or similar applied science. Primarily these men are all endowed with an inherently well developed bump of curiosity. This staff more or less prys into operating, mechanical and engineering problems of the railroad and investigates the various characteristics of material from the gold plate on the brass buttons of a train conductor to the food and water furnished the traveling public. They also investigate the quality of various liquid refreshments which can be obtained on a buffet or lounge car when traveling through certain states. Fortunately, Rule G insures to the dining car or commissary departments a reasonable return on samples of such material sent to the testing department for investigation.

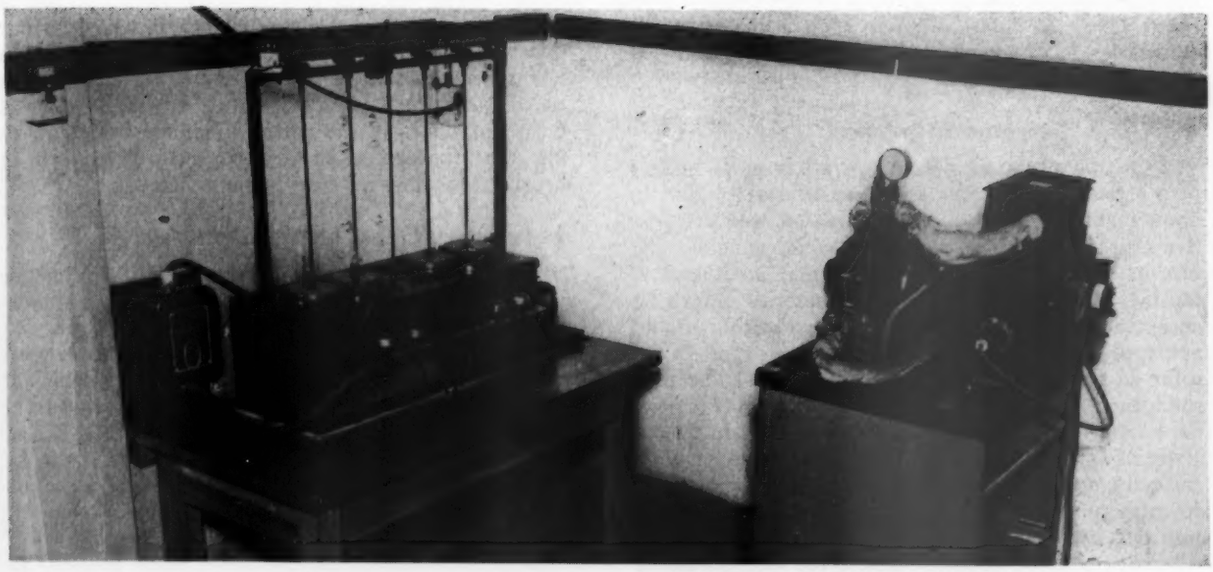
A New Problem Every Day

From this brief summary you can visualize that practically every day in a testing department brings a new job or a new problem.

During the year 1949 our department conducted investigations as to the cause of failures of locomotive, car and engineering department material on

† Chief Metallurgist & Engineer of Tests, Chicago & North Western.

* From an address presented at a Railway Supply Group luncheon held February 17, at the Union League Club, Chicago.



Special oil-testing equipment at the C. & N.W. laboratory

some 120 cases. These ranged from burned journals to broken rails, Diesel locomotive bearings, wheels, couplers, truck sides, etc.

During the year the laboratory completed some 20,000 chemical analyses of materials ranging from Diesel lubricating oil through the array of steel, coal, cement, cleaners, paint, food products, sugar and to cap the climax, a shipment of cigars from the Philipine Islands which had been damaged by sea water before being loaded into the railroad car at San Francisco. We were also quite fortunate in identifying the bugs in several infested cars of lumber containing the still-living borers with unpronounceable names, which had lived in the wood of the original trees before the lumber was prepared. The shippers had disowned this livestock and the consignee had refused to accept the lumber. On our recommendation these small, lively, but unwelcome visitors, together with their relatives and their living accommodations, were shipped back to their native state, freight collect, where at the last writing they were apparently quite happy, but still boring.

Material Inspectors Function

Our material inspectors passed upon 187 different items in varying amounts from 106,000 forgings and 126,000 journal bearings to 42,000 cast iron wheels. The total number of pieces inspected amounted to 1,680,500. in addition, some 29,000,000 gal. of Diesel fuel oil and 62,000 gal. of Diesel lubricating oil, together with some 49,000,000 gal. of heavy fuel oil were checked at the refineries or at destination.

With the advent of the Diesel locomotive, Magnaflux inspection of locomotive and car parts has been on a decided increase. During the year some 42,000 parts were inspected. This inspection revealed defects in some 1,300 pieces of material which were removed from service and scrapped to insure against failure in operation.

The monthly mileages of railroad equipment are piling up to new totals under advanced operating conditions and, therefore, less time is allowed for lay-over between departures. Higher speed of freight and passenger equipment is required and failures on the road cannot be tolerated. Two Diesel locomotives now perform the work of six former steam locomotives on many of the long hauls and through runs. The running time between terminals has been reduced to meet competition on not only other railroads, but all other forms of transportation.

The steam locomotives still in service must be maintained in serviceable condition to keep up with its new relative, the Diesel. This necessitates advanced methods of water treatment and operating control. All of this required new and better facilities for inspection and checking, with particular reference to detection and elimination of defective parts of equipment liable to prevent a successful performance of the power.

In the inspection of Diesel parts both the Magnaflux employing the dry powder, as well as the wet Magnaglo inspection, is used. The Magnaglo inspection is particularly suitable for supplemental inspection of Diesel and steam locomotive parts, such as axles, gears, motor shafts, cylinder heads, etc. These facilities are particularly adapted for examination and detection of thermal cracks frequently found in journals and minute fatigue cracks at the root of the teeth in traction gears of Diesel equipment.

The dry Magnaflux magnetic-particle inspection units are principally used on heavy steam locomotive parts, such as rods, driving axles, crank pins, etc.

In all of this work capable and well-trained operators are of vital importance. This work is usually performed by shop mechanics thoroughly trained and instructed by the staff of the testing department. Any particularly new or unusual type of defect is a problem of study by the testing department to determine the cause to attempt corrective measures.

As many of you know, representative inspectors from the test department are in the manufacturing plants of all of the supplying companies furnishing

material to the railroads. It is a peculiar fact that, for these inspectors, many times the welcome mat is taken from the door on their arrival and they are sometimes as welcome as the proverbial polecat at a Sunday school picnic.

Why Not Welcome Inspectors?

Why this situation should prevail is more or less of a mystery. Any good salesman is usually glad to show merchandise of quality to real or even prospective customers. These salesmen would consider the customer a fit candidate for a mental institution if he did not at least examine the material before he accepted it or paid his bill. Apparently this should not apply in the case of some railway suppliers insofar as railroad inspection is concerned. The railroad inspector's position must be one of fairness. He has no quota of rejections and is glad to accept material which meets railroad requirements.

Keen competition may knock the price of an article down to such a low level that rejection of any of the material by the railroad inspector could mean a difference between profit or loss to the manufacturer. For this reason, it has been our experience that all companies who maintain their own inspection department independent of production or sales, are usually the ones with which the railroad inspection departments have the least trouble. Where the inspection department of a steel company is reporting to the production department, a railroad inspector must be on his toes all the time. The sales representatives of the various companies may sometimes forget that the production department is also working on a close margin and, if some unusual or unlooked for complication arises resulting in trouble in the manufacturing plant, immediately the railroad inspector is too severe or just a natural damn crab, unfit for the job. Trouble of this nature can also interfere with the mill tonnage bonus, which does not add to the railroad inspector's popularity. It has been our experience with some of the companies that when a situation of this nature arises one of the top officials of the manufacturer immediately rushes to a good friend of theirs in the railway management requesting that inspectors be instructed to give them a break, regardless of what happens later.

Independent Test Department

We have been fortunate in all cases of this nature inasmuch as our management has adopted a hands-off policy, allowing us to fight our own battles.

Fortunately occurrences like this do not happen very often with the supply companies with which it has been our privilege to deal, or with whose technical departments it has been our pleasure to work. We get along pretty well, as our inspectors try to be diplomatic and gentlemanly, especially in manufacturing plants equipped with overhead magnetic cranes.

It is much easier and decidedly more pleasant to inspect and accept good material than to cull out that which is not acceptable. This is usually the case in plants where the inspection department is independent of the production department, and it is usually in small plants where the manufacturer expects the railroad inspector to do the mill or shop inspection work that trouble is encountered.

Railroad testing departments are made up of human beings who are not mad at anybody. Unless absolute fairness is practiced, a technical department of this nature is worthless. A real testing department is simply the watch-dog of material required by the railroad to insure safe transportation of human life and its necessities.

Oil-testing section of the C. & N. W. laboratory

ELECTRICAL SECTION

Electroplating of Wearing Parts

Norfolk and Western experience shows that the use of hard chromium plate on wearing surfaces will increase the service life of the parts more than 100 per cent

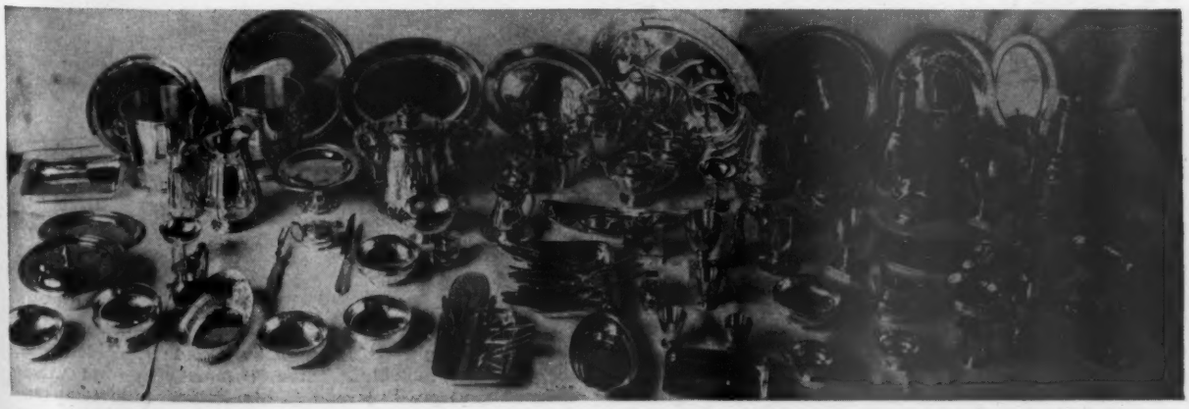
*By T. R. Boggess**

ELECTROPLATING with hard chrome has expanded greatly in the Norfolk and Western's Roanoke, Va., shops in the past year, since the plating plant was modernized and enlarged. Previously, chrome plating was limited to decorative trim and protection against corrosion. This was done by plating nickel on brass material, and copper and/or nickel on steel material, followed by a thin coat of chrome plate. The highly wear-resistant hard chrome plating is a thick chrome plate directly on steel and is used on parts subject to wear, as well as for restoration of contours on worn parts.

In plating with brass, silver, zinc, copper nickel or cadmium, both the article to be plated and the anodes are suspended in the solution. The anodes of brass, silver, or whatever type of plating required, are suspended on the positive electrode, and the article is suspended on the negative electrode. This causes the base metal of the anode to be deposited on the article to be plated. In chromium plating, a lead anode is used as the positive electrode, and the article as the negative electrode. The lead anode acts as a conductor for the chromium in the solution, and the deposit is made on the article from the solution itself.

The most satisfactory anode material for chrome plating is the 7 per cent tin-93 per cent lead alloy. Anodes of 6 per cent antimony and 94 per cent lead alloy can also be used successfully. While anodes made of iron are sometimes used in special cases, such as in the case of plating the inside of 12-ft. lengths of steel pipe, where a smaller pipe located inside of the pipe is used as the anode, they are not

* Foreman, plating department, Roanoke Shops, Norfolk and Western.



Miscellaneous dining car silverware

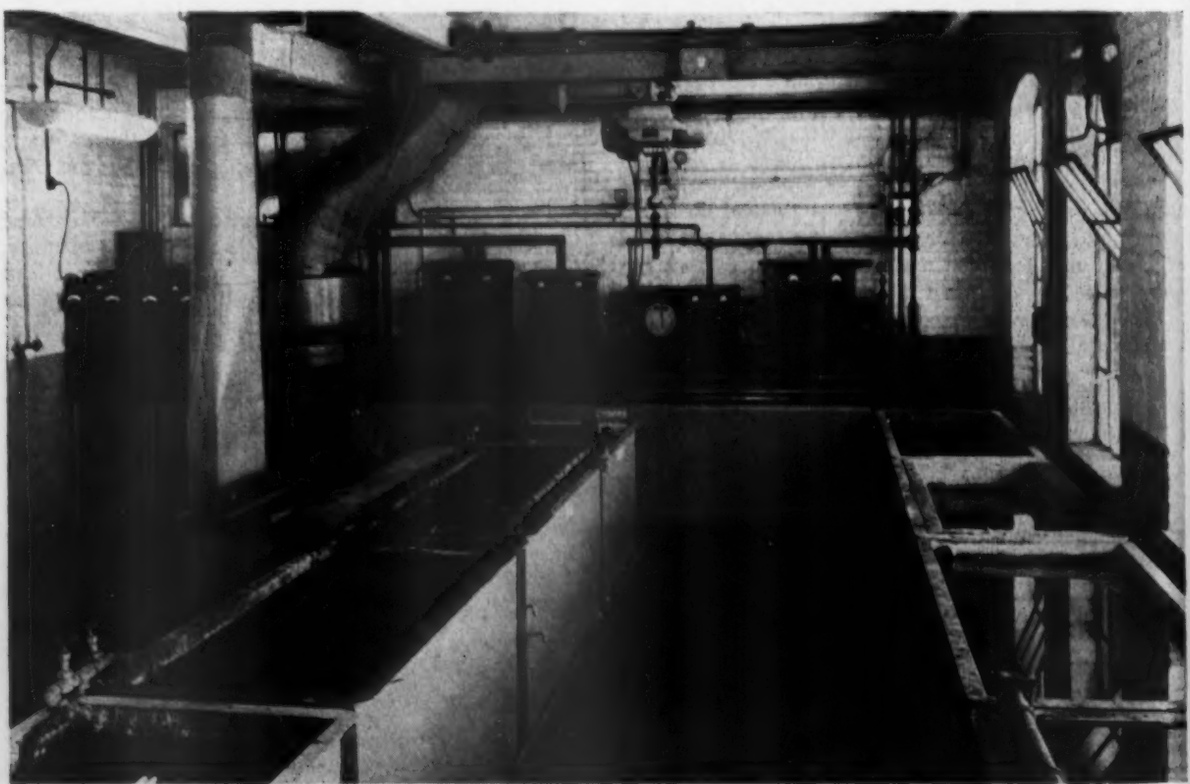
Passenger car seats and hardware after polishing and plating

generally recommended because they dissolve rapidly and contaminate the plating solution.

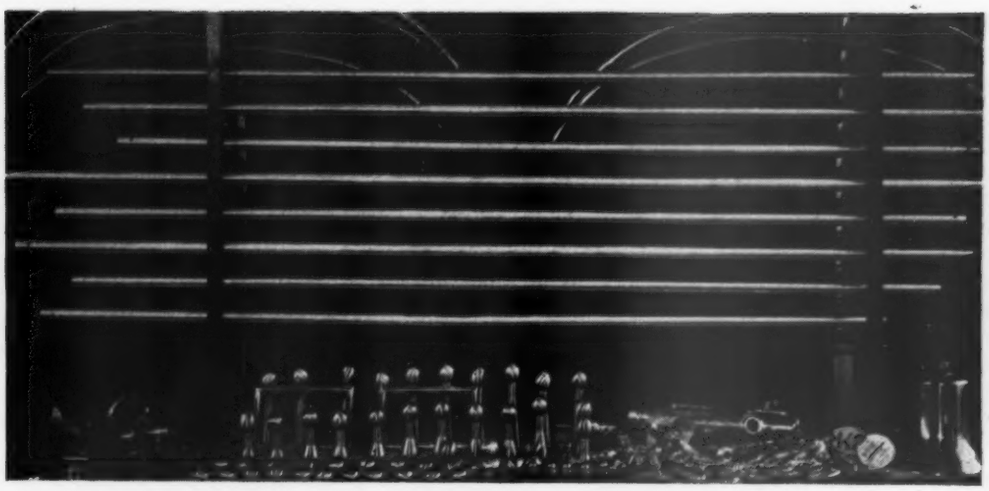
Since chrome has a very poor "throwing power," precaution should be taken in the construction of the racks to suspend the article in the solution so that the anode will conform to the contour of the article, and will be equidistant from it. Chromium solutions operated at 131 deg. F., using 2½ amp. per sq. in., will deposit .001 in. of chrome in 50 minutes. Hard chrome has been successfully deposited up to .070 in.

Use of Hard Chromium Plate

Hard chromium plate used to reduce wear and to restore contour has been applied with very good results to a number of passenger car, locomotive, and machine parts, such as bearings, pistons, nozzles, wrist pins, crosshead guides, sealing rings, cylinder



Chromium plating tanks shown in the order of their use:—From right to left:—Alkali cleaner, cold water, acid dip, cold water, chrome solution (tank across the end of room), reclaim solution, chrome strip, hot water and cold water—The chrome solution is 250 grams of chromic acid per liter and is maintained at a temperature of 131 deg. F. by an automatic temperature control—Motors, generators and exhaust fans for this room are located in the room above



Decorative parts for streamlined locomotives

liners, hydraulic parts, valve shafts, gauges, pumps, crank pin collars, gears, tools, etc. On many of the articles, only the small area subject to wear is plated. It is difficult to determine accurately the amount of saving involved from plated parts versus unplated. One test of the wearing ability of hard chrome was made by plating the outside diameters of the main and side rod roller bearing cup holders on one side of a locomotive, and using unplated ones on the other side. After six months in service, the unplated bearings showed a wear of .055 in., while the plated bearings had only .003 in. wear. Another finding was that the bushings used with the unplated bearings required renewal, while the bushings used with the plated bearings were found to be in good condition. None of the bushings were plated, as it is not at present recommended that chrome should be used against chrome. On parts subject to wear, hard chrome plating will generally increase service life 100 per cent or more.

General plating room, showing tanks for alkali cleaner, cold water rinse, acid dip, cyanide copper, cold water rinse, hot water rinse, unichrome copper, bright nickel, cadmium, alkali cleaner, cold water, brass, silver strike and silver solution—A locomotive main rod, 138 in. long and weighing 834 lb. is shown after being removed from the bright nickel tank

How the Plating is Done

The hard chrome plating room in the Norfolk and Western's Roanoke shops has the tanks arranged in a U shape around the room. Heavy objects are moved from tank to tank by the use of an overhead one-ton electric crane. Objects to be plated, after being cleaned in the buffing room, are first placed in a tank and washed in petroleum spirits—next they are moved to the alkali tank where they are rinsed in cold water—then stop-off lacquer is applied to the parts not to be plated, and the article placed in a rack. The next step in the process is the electro cleaner tank, followed by a cold water rinse, then into the acid dip tank, and another rinsing in cold water. After this, the article is ready for plating and is placed in the chromium plating tank. This steel tank is 144 in. long, 30 in. wide, and 40 in. deep, with a capacity of 740 gal. of solution. The inside of the tank is coated with acid resisting material and lined with acid resistant brick. This tank is completely automatic and can be operated overnight without attention. Two 3,000-amp., 6-volt generators are connected in parallel, so that either or both can be used at one time to furnish the current for the tank. This tank is equipped with an efficient arrangement of individual panels, so that five different objects can be plated at one time, using different current densities without interfering with each other.

After the object is plated, it is placed in the reclaim tank to remove excess chromic acid. The water in the reclaim tank is then used to replenish the water in the chrome tank when necessary, thus effecting a saving of chromic acid. The part is rinsed in a tank of hot water, and is then unracked and the stop-off lacquer removed.

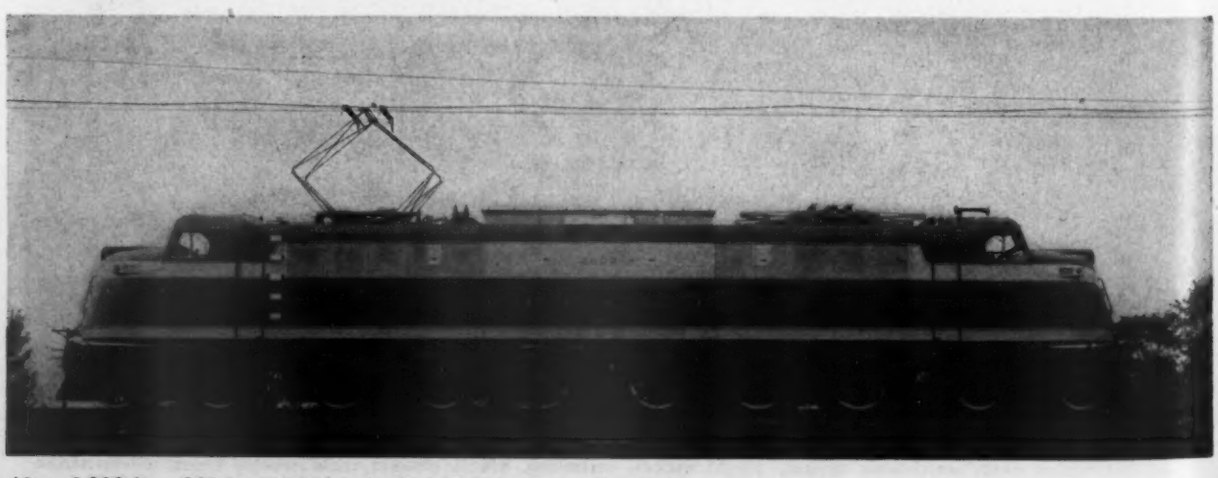
To relieve any strains which may have been caused by occluded hydrogen, it is good practice after the article has been unracked to immerse it in an oil bath, maintained at 250 to 350 deg. F., from one to three hours. This heat treatment may also be carried out in ovens or in boiling water. The thickness of the plate determines the length of treatment.

An important part of plating is the cleaning of the article, which precedes the plating. Grinding film and grease must be removed completely. Sometimes these films can be removed by lightly brushing with some abrasive material such as fine emery, or pumice and water on a tampico brush or wheel. A greaseless buffing compound on a soft unstitched buffing wheel may be used also. Alkaline electro cleaner solutions are widely used. Cleaners of this type are usually of proprietary composition, and should be made up and operated in accordance with the supplier's recommendations. The 210-gal. cleaning tank in the chrome plating room is equipped with steel anodes and 6-volt direct current, controlled by a double-throw switch. A small deposit from the anodes is put on the article, then the current is reversed and the deposit is removed, bringing with it grease, grinding film, etc., leaving a perfectly clean surface.

An electrolytic acid etching treatment can be used for cleaning light rust and other iron compounds from steel or cast iron. This is accomplished with a reversed 6-volt current in a chromic acid or sulphuric acid solution, and leaves a slightly roughened surface admirably suited for electro-deposited chromium. The sulphuric acid cannot be used where the shape of the work or racks does not permit free rinsing due to drag-in of the entrapped sulphuric acid into the chromium solution. When operating with a chromic acid etch, work can be transferred directly from the etch to the chromium plating bath without intermediate rinsing, or the etching process can be done in the regular chromium plating solution. When this practice is followed, close attention must be kept on the solution to prevent its building up with iron.

In addition to the chrome plating, there are other tanks in the main plating room, equipped for silver, brass, cadmium, bright nickel, unichrome copper, and cyanide copper plating.

All solutions in the plant are maintained and kept to standard specifications, and they are analyzed and filtered periodically.



New 4,000-hp., 231-ton, 3,000-volt d.c. electric locomotive built by the General Electric Company for the Chilean State Railways

Rotating Electric Equipment For a Gas-Turbine Locomotive*

The electrical equipment required is, for the most part, the same as that on a Diesel-electric locomotive but differs in certain essential details

By O. C. Coho†

THE basic problem in the application of electric drive is that of converting the prime-mover power available in the form of torque at high rotative speed, to tractive force at the driving wheels over the range of locomotive operating speed. It is desired to make the full prime-mover power available as tractive force, from the minimum locomotive speed at which point the wheels will slip, to the maximum full-power speed. The latter is usually a high fraction of the maximum permissible locomotive speed as dictated by other considerations. At low locomotive speeds, the prime-mover power appears as high tractive force whereas, at high speeds, the tractive force decreases essentially in inverse proportion to the locomotive speed. The system is thus basically a torque converter of infinitely variable ratio within the rating capabilities of the equipment.

In the design of such an electric-drive system, cognizance is taken of the fact that below a certain locomotive speed, full power application is generally of limited duration, such as in starting a train or ascending a grade. Advantage is taken of this fact to utilize the short-time torque overload capacity of electric apparatus, thus resulting in smaller, lighter equipment than would be required if continuous operation in the low-speed range were provided.

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Gas-Turbine Prime Mover

The type of gas turbine selected for this application is essentially a constant-speed, constant-torque power plant at full power and, in this sense, is com-

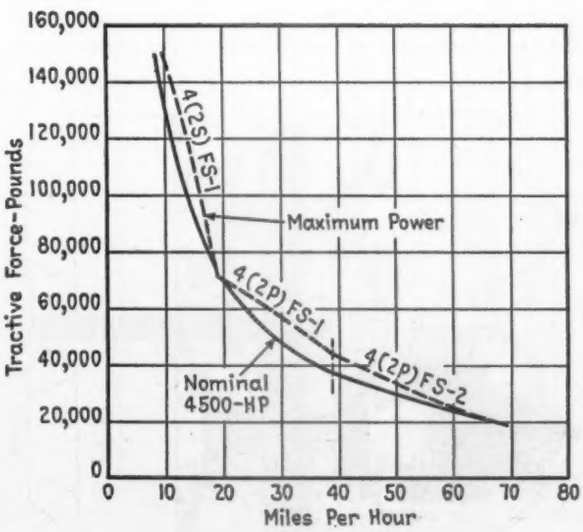


Fig. 1—Speed-tractive-force curve showing full power performance

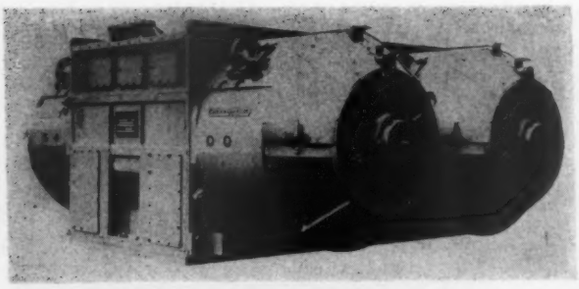


Fig. 2—Traction-generator gear unit assembly

parable to the Diesel engine. Its nominal rating is 4,800 hp., of which 4,500 hp. is allocated for traction, and 300 hp. for auxiliaries. This rating is stipulated at 80 deg. F. ambient and 1,500 ft. elevation. However, the turbine power available is a function of both ambient air temperature and pressure (altitude). At low temperatures and elevations, the power capabilities of the turbine are somewhat higher than at high temperatures and/or altitudes.

Thus, the first problem encountered in this application was that of selecting the rating point about which the design of the electric propulsion equipment should be centered. To provide equipment suitable for transmitting the maximum available power-plant output over the entire range of locomotive speed would mean carrying much extra and expensive equipment weight on the locomotive when ambient conditions were such that this peak power was not available. Accordingly, the electric transmission was finally chosen to handle 4,500 hp. for traction over essentially the entire speed range.

Locomotive Performance

The full-power performance of the locomotive is illustrated in Fig. 1, which shows the relationship of tractive force and speed. One of the curves represents the locomotive characteristic at the nominal 4,500-hp. rating, and the other the limiting characteristic permitted by the electric drive when more than nominal power is available from the power plant.

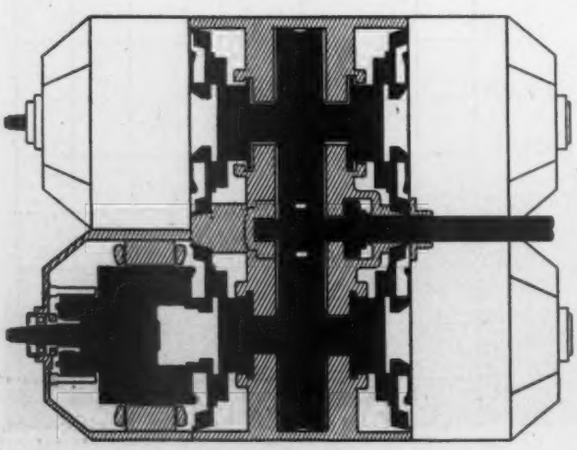


Fig. 3—Schematic section of generator gear unit assembly

The equipment is designed for a maximum tractive force of 150,000 lb. This is dictated by wheel slip based on 30 per cent adhesion. The maximum speed, 69 m.p.h., is determined by the limiting speed of the traction motors. The tractive force at the continuous rating of the traction motors is 77,800 lb. at 18 m.p.h.

This performance characteristic is obtained through the use of eight traction motors receiving their power from four traction generators geared to the gas-turbine power-plant shaft. Each generator independently furnishes power to two traction motors. From standstill to 19 m.p.h., the two traction motors are connected in series across the generators, and from 19 to 69 m.p.h., they are connected in parallel. At 38 m.p.h., the motor series fields are shunted to extend the speed range over which full power can be handled.

Traction Generators

Considerable thought was given to the arrangement and design of the traction generating equipment. Inasmuch as the full power-plant speed is 6,700 r.p.m., gearing is necessary to reduce the speed to a value which can be handled by traction generators built within current design practice. The design was ultimately resolved into a single self-contained generating unit consisting of a gear box with four overhung, close-coupled generators. The gearing consists of a single 6,700-r.p.m., double helical pinion driving two low-speed gears at 1,600 r.p.m. The pinion is driven by a splined shaft, so designed as to be readily removable in the event of interchange of equipment. The gears and pinion are supported and aligned within the box by their own bearings. Forced lubrication of the gears and bearings is obtained from the main lube oil system which also handles the power-plant bearing lubrication.

The four single-bearing generators are end-bell supported from the walls of the gear case. Each of the two low-speed gears drives two generators, one on each side, through steel disk-type flexible couplings. The gear bearings are designed to sustain not only the gear loading itself, but also the thrust and radial loads due to the weight and coupling of the generators. The overall design is such that the generators may be mounted on the gear box on the assembly floor, and the complete assembly installed in the locomotive as a unit. Lineup within the locomotive, between the generating unit and the power plant, is then a relatively simple problem. Individual generators may be readily removed and replaced at any time after complete unit installation without disturbing the lineup of any other equipment. The complete four-generator gear unit weighs 38,000 lb. The generator frame has an outside diameter of 43½ in. and an overall length from bearing cap over coupling of 40 in.

Each generator is nominally rated at 1,125 hp. input for traction, consistent with the nominal power-plant rating, and in accordance with A.I.E.E. standards for this type of equipment. The generators are of the non-compensated type without pole face windings. Each machine has six exciting poles and six commutating poles. They are conservately designed, based on proved practice as regards mechanical and

dielectric stresses, heating and ventilation, commutation and performance limits.

The generator volt-ampere characteristic curve is shown in Fig. 4. The continuous rating of the generator is 1,125 hp., 1,600 r.p.m., 535 volts, 1,450 amp. This figure shows also the limiting power curve to which the generators may be loaded when excess power is available from the turbine.

The generators are self-ventilated, each one being

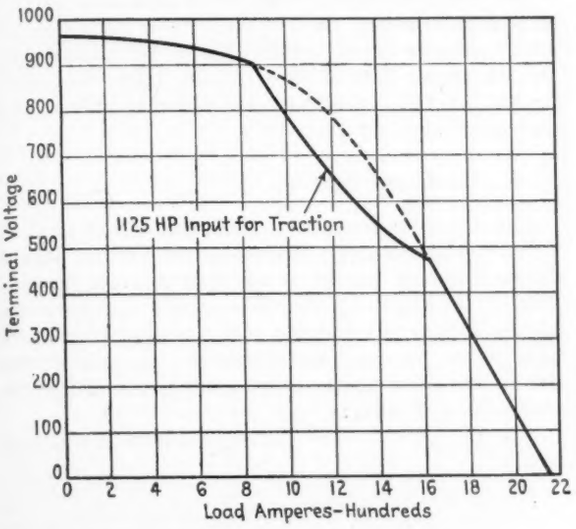


Fig. 4—Generator characteristic curve for a 4,500-hp. gas-turbine electric locomotive

equipped with its own radial-discharge type fan located at the back of the generator as part of the steel-disk coupling assembly. Ventilating air is drawn from within the cab after it has passed through filters located in the side walls of the locomotive. The air enters the generators at the commutator end and then divides; part passing through the commutator risers and the armature core, and part passing over the surface of the armature and between the field coils. The air is discharged in chambers within the gear box and subsequently directed vertically out of the roof of the locomotive.

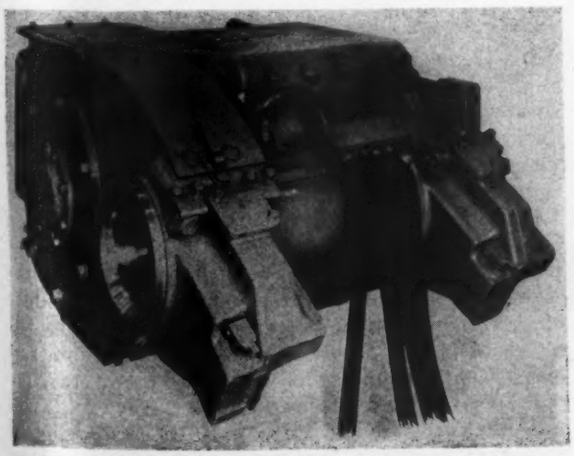


Fig. 5—GE-752 traction motor

Comparison With Diesel-Electric Traction Generators

The generators are quite similar in general design and appearance to conventional Diesel-driven generators designed for locomotive application. They embody many features inherent in the Diesel-electric units, such as short end windings, short commutators, and class B types of insulation. These features, plus the single anti-friction bearing construction and end-bell mounting, result in a compact "pancake" design of relatively short length. This, in itself, is a significant item contributing to reduced locomotive length.

The generator field structure is somewhat simpler than a Diesel-driven generator in that the conventional cranking winding is omitted. Although one of the generators serves as a cranking motor during turbine starting, separate shunt excitation is provided in this case. A further difference is found in the magnetic path design. In order to maintain good commutation at higher than normal rated horsepower, but within normal field and armature current limits, the magnetic structure is relatively heavier than that in the usual Diesel-driven generator. This allows for the simultaneous existence of large exciting and commutating fluxes associated with such high horsepower, without the adverse effect of saturation on commutation.

Traction Motors

General Electric model GE-752 traction motors are used. The locomotive has a total of eight motors, one on each axle. They have heretofore been rated at

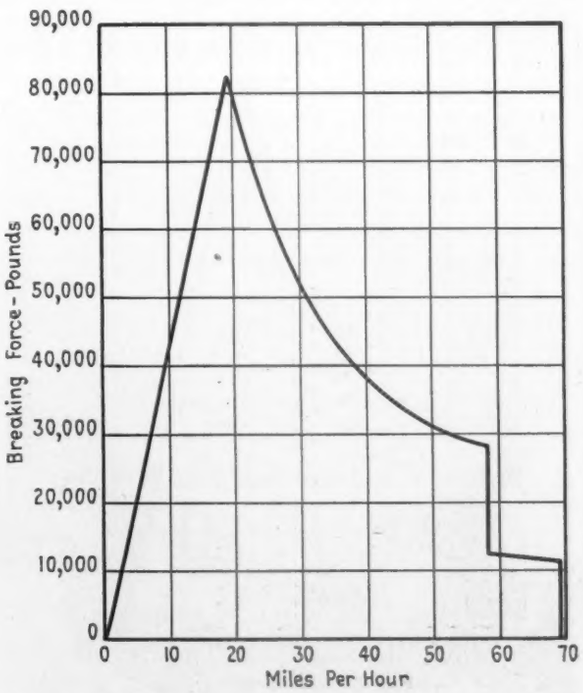


Fig. 6—Speed-braking-force curve for a 4,500-hp. gas-turbine electric locomotive

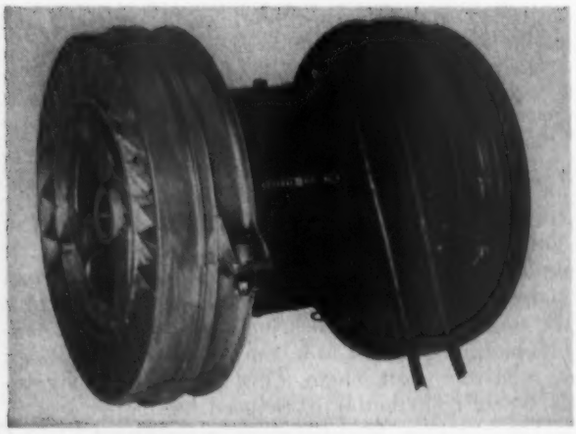


Fig. 7—Braking-resistor blower unit

900 amp. continuous for application at 500 hp. with forced ventilation of 2,300 c.f.m. air flow. For the gas-turbine electric application at 562.5 hp. per motor, the core losses become of greater relative significance so that the continuous rating has been reduced to 875 amp. Based on 74/18 gearing with 42-in. diameter wheels, this corresponds to a continuous tractive force of 9,725 lb. per motor or 77,800 lb. total at 18 m.p.h. The motors are applied to transmit the full available horsepower over the speed range from 30-per cent adhesion at 8 m.p.h. to 95 per cent of full speed 66 m.p.h.

Dynamic Braking

Since the locomotive has been designed particularly for use on freight applications, dynamic braking has been provided. This braking may be used independently or together with the train air brakes. The traction-motor armatures are loaded in pairs across fixed braking resistors while the separate excitation for the motor fields is furnished by two of the main generators. Braking control is obtained by varying the motor field excitation. The maximum braking rate is determined by motor armature and field heating as well as commutation limits. Between 19 and 58 m.p.h., 4,100 braking rail horsepower is available. Below 19 m.p.h., the available horsepower falls off essentially in proportion to speed, whereas above 58 m.p.h., the braking is restricted to 2,000 hp.

The braking resistors are force ventilated by two axial-flow blowers, each driven by a series motor which obtains its power through a permanent connection across part of the resistor. Thus, maximum resistor ventilation is obtained automatically at the maximum braking rate.

Fig. 8—Traction-motor blower unit

A. C. Auxiliary System

Entirely aside from such functions as cab heaters, train control, battery charging, etc., more than a dozen different auxiliary operations must be performed, powered by electric motors. To have the highest degree of reliability and a minimum of maintenance, as many of the auxiliaries as possible are driven by three-phase induction motors. These include the following:

	Function	Hp.		R.P.M.
1	Fuel sump pump	3		1,150
1	Fuel booster pump	3		1,150
1	Lube oil pump	8.5		1,525
1	Coolant pump	5		2,335
2	Coolant radiator fans	6	each	1,140
4	Amplidyne exciters	8.5	each	2,340
4	Traction motor blowers	15	each	4,650

A six-pole, three-phase alternator driven through a flexible steel-disk coupling from a shaft extension on one of the main traction generators furnishes power for the a.c. system. Inasmuch as the power plant operates at variable speed, depending upon loading, the frequency of the system will vary between 80 and 48 cycles. The rated voltage of the system was chosen as 290 volts, 80 cycles so that normal motor flux conditions would prevail when checking or testing with standard 220-volt, 60-cycle power.

Class B insulation is applied on all this equipment. To reduce size and weight, the designs are such that the temperature rises are somewhat in excess of those encountered in normal industrial practice. However, in view of limited field experience with this line of apparatus, the temperatures were kept well below the A.I.E.E. standards for transportation equipment. In all cases where the motors may operate in dirty or oily atmospheres, the totally-enclosed fan-cooled construction has been used.

The motors are permanently connected across the alternator. One of the first steps in the procedure of starting the main power plant is to excite the alternator field. As the plant is started from rest and brought up to speed, each auxiliary motor, according to its break-away torque requirements, will begin turning at between 3 and 13 cycles applied frequency, and from then on come up in speed along with the main power plant. There is no modulation

of the alternator field. The unit is of the self-regulating type with sufficient capacity, in case of emergency, to start the largest motor at full frequency and rated excitation without the voltage dropping to the point where other loaded motors may stall. The alternator is nominally rated at 150 kva., 80-per cent power factor, 1,600 r.p.m., 290 volts, 3-phase, 80-cycles.

The traction-motor blowers are perhaps the most unique of the a.c. auxiliary equipment, involving special development for this locomotive. The basic locomotive design is such that the traction-motor ventilating air must be furnished through restricted duct work involving high pressure drops. Blower requirements indicated a fan rated 5,375 c.f.m. at 8.5 in. of water static pressure. This delivery is obtained by the use of a 16½-in. diameter, 24-blade, single-stage, axial-flow fan at 4,650 r.p.m. The fan, contravane, and 15-hp. motor are assembled as a self-contained unit. The motor core and windings are totally enclosed. Cooling is obtained from the high-velocity air flow passing over the outside of the motor frame. Rotation is about the vertical axis. To insure satisfactory bearing lubrication at the high rotational speed, metered oil lubrication features were utilized for both bearings.

D. C. Auxiliary System

The auxiliary functions which must be in operation prior to and during power-plant starting, before a.c. power is available, are handled by an entirely separate d.c. system. Such operations as lighting, locomotive and fuel heating, control and turbine cranking are in this category. This system is centered about a 75-volt storage battery and two identical d.c. auxiliary generators. One of these is driven through a flexible steel-disk coupling from a shaft extension on one of the main generators. The other is driven by a Diesel engine and, normally, is on the system only when the main power plant is not in operation.

The battery is a 32-cell lead-acid type having 426 amp.-hr. capacity. It must furnish the auxiliary power required during the period of power-plant cranking, and accordingly was chosen to have ample capacity to handle at least three successive starts without the necessity of recharging.

The auxiliary Diesel-driven generator also furnishes power to one of the main generators operating as a motor. This occurs during power-plant cranking wherein approximately 140-kw. is developed when driven by a 210-hp., 2,100-r.p.m. Diesel engine. This cranking power is applied up to over 50 per cent speed until the power plant is self-sustaining by its own developed power. For this application, the generator is rated at 210-hp. input, 310/180 volts, 460/700 amp., 2,100 r.p.m. For battery-charging service, both the Diesel-driven generator and the identical turbine-driven auxiliary generator are rated 50-kw. output, 75 volts, 667 amp., 800 to 1,600 r.p.m. The generators are designed to permit a conventional voltage regulator to operate with stability over an 800 to 1,600-r.p.m. speed range.

Part of the power-plant shut-down sequence involves cranking at approximately 7-per cent speed to equalize various power-plant temperatures. This is done at 75 volts, thereby enabling the Diesel-driven generator to charge the battery at the same time.

One significant function operated from the d.c. auxiliary system is the stand-by lube oil pump. Prior to power-plant starting, the main lube oil is heated and circulated throughout the system by a pump driven by a 75-volt motor. This pump also serves as an automatic standby during locomotive operation in the event of failure of the a.c. motor-driven pump.

The following is a general listing of the various motors and generators connected with the auxiliary d.c. system:

	Function	Power	R.P.M.
1	Diesel-driven generator	50 kw.	800 to 1,600
1	Turbine-driven generator	50 kw.	800 to 1,600
1	Stand-by lube pump motor	13 hp.	1,550
1	400-cycle control m-g set	3 hp.	3,600
1	Water booster pump motor	3 hp.	1,750

(*Continued on page 345*)

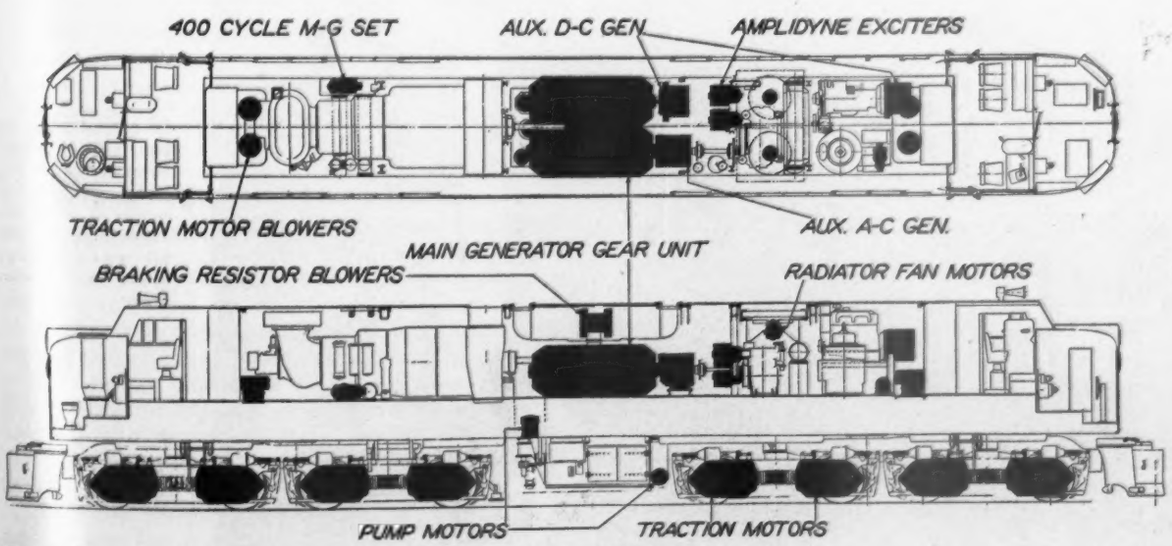


Fig. 9—Layout of apparatus for a 4,500-hp. gas-turbine electric locomotive

Diesel- and Axle-Driven Generators in Parallel

Rock Island installation shows that it is practicable to train-line Diesel-electric undercar power plants with axle-driven generators

THE Chicago, Rock Island and Pacific train, "Peoria Rocket", makes two high-speed round-trips daily between Chicago and Peoria, Ill., a total of 644 miles in less than eleven hours scheduled time, including three to five stops on each one-way trip. In this operation, the train is standing or being turned during 14 hours out of each 24 hours. The cars are air-conditioned, and the operation does not permit of adequate use of standby power.

The train consist is changed at times to suit traffic requirements, but always included in the train are a three-car articulated unit and an observation car. Each car of the three-car unit is equipped with a 20-kw., axle-driven generator, but under the required operating conditions, these could not be expected to meet the load requirements.

Accordingly, the observation car was equipped with a Waukesha Enginator consisting of a Diesel engine coupled to a 25-kw., 64-volt d.c. generator assembled in a power package with the necessary control apparatus. This undercar power plant supplies all the power requirements for the observation car and, through a two-wire train line, aids in keeping the batteries fully charged on the three articulated cars. Other cars which may be used on the train are equipped with Waukesha air conditioning and 7½-kw. generator-driven engines using propane as fuel. These cars are not trainlined.

The trainlines on the four cars consist of two No. 4/0 wires with overhead connectors in the vestibules which are normally connected. No special voltage or current control has been found necessary, and no changes were made in car lighting or air conditioning wiring. The voltage setting on all generator regulators is 76 volts. The current setting on the axle generator regulators is 250 amp., while that on the Enginator is 300 amp.

In normal operation, the Enginator supplies just enough current for the observation car. When the train is standing, the Enginator delivers its full cur-

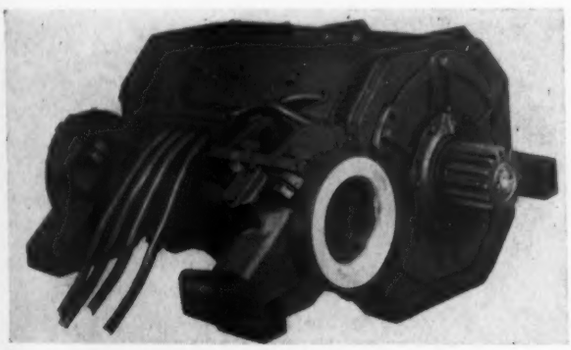
In a trial made on the station platform at Peoria, Ill., one power unit was removed and another applied with all connections made in 35 minutes

rent output of 300 amp. The excess above the requirements of the observation car flows through the trainline to the other three cars.

The enginator runs continuously, except for the brief periods required for removing the unit and replacing it with a new or overhauled unit supplied by the manufacturer. The car was equipped originally with a 600 amp.-hr. battery in two boxes. One of the boxes was removed to make place for the power plant and the capacity of the battery thus reduced to 300 amp.-hr. The Enginator is supported under the car on a roll-out mounting which facilitates easy replacement. Electrical connections, fuel oil lines and steam-heat exchanger lines are designed for quick disconnection and reconnection. In a trial made on the station platform at Peoria, a power unit was removed, and a duplicate replacement unit installed in 35 minutes. A Hyster industrial lift truck was driven alongside, its fork lift thrust under the Enginator unit, and the latter lifted from its mountings. Then it was only necessary to back the truck away, set down the load, pick up the replacement unit, roll it into place, and connect it.

The four cars, three equipped with axle generators, and one with the Diesel-engine-driven generator have been operating in parallel since September 1, 1949. Since these cars were placed in service no important difficulties have been encountered.

CONSULTING DEPARTMENT



Gear Ratio Vs. Tractive Force

Does changing the gear-ratio or wheel diameter have any effect on the speed-tractive-force curve of a Diesel-electric locomotive?

The Diesel-Electric Is a Constant-Horsepower Locomotive

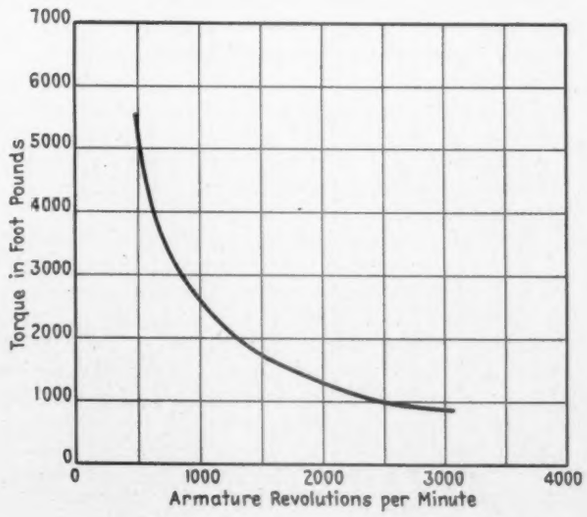
Change of gear ratio or wheel diameter does not have any effect on the speed-tractive force curve of a Diesel-electric locomotive, except for slight variation in efficiency of the electrical equipment.

Many people concerned with the proper application and use of Diesel-electric locomotives are confused on this question largely by their experience with electric motors supplied by power from a central station.

The series traction motor, for any given current and voltage, has a definite tractive force and speed for each gear ratio and wheel diameter.

In the case of the Diesel-electric locomotive, the Diesel engine has a definite rated crankshaft output, which cannot be exceeded without overloading and stalling the engine. Because of this engine output limitation, the general voltage characteristic and the generator control purposely are arranged to maintain a constant maximum output. With any increase in tractive force and load current, the controls automatically make a corresponding reduction in generator voltage. Thus, the product of generator current and voltage remains the same at all points in the operating range on the locomotive curve.

Any increase in wheel diameter or reduction in gear ratio on a Diesel-electric locomotive tends to increase speed and current. Generator control, however, causes a corresponding decrease in generator voltage, maintaining constant generator output. The voltage decrease and current increase reduce the traction motor armature speed sufficiently to cancel the speed increase which otherwise would be obtained by the change in gear ratio or wheel size. Thus, the speed-tractive force curve of a Diesel-



electric locomotive is not changed by a change in gear ratio or wheel diameter.

The question may be answered also by reference to the locomotive speed-tractive force formula:—

$$\text{Rail Horsepower} = \frac{\text{Pounds Tractive Force x M.P.H.}}{375}$$

With the Diesel-electric locomotive, controls permit no increase in maximum rated horsepower. With constant horsepower, the formula permits one characteristic curve, and only one. Therefore, changes in wheel diameter or gear ratio do not alter speed-tractive force characteristics of a Diesel-electric locomotive.

DONALD R. CAMPBELL
Westinghouse Electric Corporation

Ratios Are Chosen to Meet Service Conditions

Instead of making a definite assertion to the question it seems far more satisfactory to show the characteristics of the drive of a Diesel-electric locomotive and let that answer the question for itself.

The series motor is a common medium of power transmission from prime mover to the rails in a locomotive. Both alternating and direct current motors are in general use throughout the world wherever any form of electric locomotive is operated.

In American practice, series motors are most generally suspended from the driven axle at one end and supported by a torque spring connected to the truck frame on the other and are equipped with a pinion which meshes with an axle gear on the driven wheels. Further refinements may include some form of flexible drive, but this feature is irrelevant to the matter under discussion.

The speed torque curve of a series motor may be determined by loading the motor through a prony brake or a calibrated dynamometer, taking simultaneous readings of impressed voltage, amperage, speed and torque output. As the load is increased the speed decreases and conversely as the load is reduced, the motor speed increases. As the speed increases, the motor counter e.m.f. which opposes the impressed voltage, rises and the current is reduced. Conversely as the speed is reduced, the current increases. By reducing the load, the speed of the motor is increased but the speed torque curve cannot be brought to zero load as the motor will reach destructive speeds if run at no load with normal voltage impressed. At each speed there is a corresponding torque.

Torque in a motor is a constant times the product of field current and armature current. As the field current and armature current are the same in a series motor, this formula can be stated for a series motor as torque equals a constant times current squared. This torque characteristic of the series motor makes it the most practical type for traction service for when the motors are called upon to start a train from standstill, doubling the applied current gives the motors four times the starting torque, while if a shunt motor were used, doubling the armature current with full shunt field would only furnish about 1.4 times the starting torque. After the train begins to move the reduced tractive force needed to keep it in motion is immediately translated into speed and rapid acceleration is obtained.

The horsepower rating of a traction motor is usually considered as mechanical output at the car axle and is less than that at the armature shaft due to losses in gearing, suspension bearings, etc., and the force exerted at the thread of the wheels on the locomotive axle is known as the tractive force of the motor and this value is usually expressed in pounds. Any change in gear ratio, wheel diameter or applied current effects the value of the tractive force of the motor.

Knowing the speed-torque curve for a traction motor it can be translated into a speed tractive force curve for the locomotive by multiplying by a constant determined by the gear ratio and the diameter of the wheels, taking into consideration that the motor curve has been plotted in revolutions per minute and the locomotive curve in miles per hour.

The speed tractive force for a Diesel-electric locomotive may also be found by the formula, K times horsepower divided by miles per hour, as shown in the May, 1949, issue of the Railway Mechanical Engineer. The constant used for K is 308 and the tractive force value is in units of 1,000 lb. This curve seems to apply to any gear ratio in a locomotive and has its limits determined by the safe permissible speed of the motor armature. To arrive at this safe speed the calculations are as follows:

$$\text{R.P.M. of Motor} = \frac{\text{Miles per hour} \times 5{,}280 \text{ ft.} \times 12 \times \text{No. of teeth in axle gear}}{60 \text{ min.} \times \text{diameter of wheels in inches} \times 3.1416 \times \text{No. of teeth in motor pinion}}$$

For a 40-in. wheel this formula will cancel out until Motor

$$\text{Revolutions per Minute} = \frac{\text{Miles per hour} \times \text{teeth in axle gear}}{.119 \times \text{teeth in pinion gear}}$$

From locomotive specifications available to the writer the following motor speeds are found:

Locomotives	Top speed, m.p.h.	Gear ratio	Motor r.p.m.
Fairbanks, Morse:			
1,500 hp.—42-in. wheels	65	63/15	2,183
	75	62/17	2,039
	85	60/19	2,232
6,000 hp.—42-in. wheels	69	70/17	2,274
Electro-Motive:			
1,500 hp.—40-in. wheels	55	65/12	2,503
	65	62/15	2,259
	71	61/16	2,274
	77	60/17	2,283
	83	59/18	2,286
	89	58/19	2,283
	95	57/20	2,275
	102	56/21	2,286
2,000 hp.—36-in. wheels	117	52/25	2,271
	98	55/22	2,282
American Locomotive:			
1,500 hp.—40-in. wheels	65	74/18	2,245
	75	65/18	2,275
	80	64/19	2,282

This tabulation gives the highest motor speed found to be 2,503 r.p.m., the lowest 2,039 r.p.m. and the average 2,266 r.p.m. This average appears to be a satisfactory motor speed for efficient and

New Diesel-electric locomotive repair shop of the St. Louis-San Francisco at Springfield, Mo., has been placed in service—The picture was taken on April 14 when the shop was nearing completion

trouble free operation and the various locomotive manufacturers have apparently kept near this value when designing a locomotive drive for a maximum speed rating by suitable choice of gear ratio and wheel sizes.

As long as sufficient rail clearance to the bottom of the gear case is maintained, further increase in starting tractive force of a locomotive may be obtained by providing higher gear ratio and smaller wheel diameters, but this will be at the expense of safe top speed of the motors. Other limiting factors of this increase in tractive force would be adhesion at the rails and strength of draft gear at locomotives and cars.

When comparing locomotives of the same horsepower rating it is essential that the tractive force at the wheels be stated. The horsepower available will be the same but the pulling power translated into thousand-pound units will vary greatly in different locomotives and this tractive force will also vary at different speeds.

When comparing locomotives of different horsepower rating the one having the highest horsepower will not always be able to pull the most cars, for again the tractive force at the wheels must be stated and the top safe locomotive speed considered before a fair comparison can be made. It is permissible motor speed or perhaps voltage at one end of the speed-tractive force curve which limits operation, while at the other end it is permissible current values or the limits of adhesion. The change of gear ratio or wheel diameter does not change the speed-tractive force curve of a Diesel-electric locomotive but it does make available the full engine power within the limits of desired tonnage moved and speed maintained that its class of service demands.

F. A. Totams
Electric Maintainer
Florida East Coast

Rotating Electrical Equipment

(*Continued from page 341*)

An additional 25-kw. is furnished for various other auxiliary services including heating boiler, lights, cab heaters, and defrosters, train control, battery charging and field excitation.

Conclusions

As is to be expected, the advent of the gas-turbine power plant as a prime mover, with its accompanying light weight and small space per unit horsepower, tends to focus more attention upon the rotating equipment, from the standpoint of the overall locomotive design. This is evidenced by its predominance in the locomotive as shown by the layouts of Fig. 9 where the electric rotating equipment is silhouetted. This apparatus makes up approximately 25 per cent of the weight of the locomotive; 22 per cent of which is for propulsion, and 3 per cent for auxiliary drives. It is of interest to point out that the propulsion equipment, including gear box, main generators and traction motors weighs approximately 22 lb. per hp. This compares with the value of 25 lb. per hp. for a typical Diesel-electric freight locomotive of comparable axle loading.

Based on tests and locomotive operation to date, it is felt that all functions are being performed in a highly satisfactory manner. Fundamental difficulties have yet to appear in any of this equipment, either performance-wise or from a general maintenance standpoint. This is in spite of many exceptional overloads and abuses attending the various initial tests of a special nature which have been part of the performance evaluation of the power plant and locomotive to date.

EDITORIALS

Is the Freight Car a Finished Product?

The freight car is probably the least colorful part of the physical plant of a railroad. The box car, particularly, aside from its growth in size and its corrugated ends, has not changed greatly in external appearance for the past 50 years. But the 50-year-old car is a long way from being a prototype of the box car of today. Trucks have passed through one cycle of standardization and are now undergoing a second cycle of development to adapt them to operate safely at speeds up to 80 or more miles an hour and to protect the car and its lading from damaging shocks, both vertical and lateral.

Other features of present-day freight cars which make them the effective factors in transportation which they proved themselves to be during and since World War II are roofs which are tight and durable; draft gears which meet minimum specifications set up by the Mechanical Division; materials of construction which permit building lighter-weight cars or the attainment of longer life or both; wheels, both chilled-iron and steel, which have been progressing in strength and reliability for many years; truck frames and bolsters, the design of which has been refined and balanced in the interest of reliability; and the standardization of couplers, thus eliminating the former impossibly complex variety of spare parts which each railroad had to carry to protect the large number of coupler designs at one time in service.

One of the greatest improvements, which was attained in time to influence the safety of freight-train operation during World War II, was the completion of the transition from cars of inadequately reinforced wood construction to steel cars designed to uniform strength specifications. The variations in the ability of cars to resist shocks during this transition period, which included World War I, were the cause of many wrecks, with destruction of cars and contents and disruption of the regularity of service.

These features of freight cars as they are today represent a kind of engineering research and development which is of a quality equal to that represented in the motive power developments of the same period. They are cited as a reminder of the tremendous advance in reliability of freight-train operation, certainty of deliveries and reductions in maintenance which they have brought about during the past 50 years. The economic effect of some of them is by no means yet complete; only as they are actually incorporated in all cars in service for which they are suitable will complete benefits be realized.

Some of these developments which are now going into service, but the influence of which is not yet predominant, are trucks for high-speed service, the cushion underframe, eight-foot doors to facilitate loading and unloading box cars with power trucks, better steel floors in gondolas and box cars, in the latter of which the currently used wood floors are proving of inadequate strength, the load-compensating brake which is now either in service on or on order for several hundred cars, and higher-strength of lighter-weight materials of construction.

A review of improvements and refinements such as have been made in freight cars during the last 50 years tends to raise the question as to whether developments have not reached the end of their course. It takes more imagination than the casual observer is likely to possess to deduce from such a past a future equally prolific in further developments and improvements which will make freight cars even more effective instruments of freight transportation than they have been in the past. Such a deduction, however, is likely to be more nearly the truth than the inference that nearly everything has been done and there is little hope for further developments in the future. Already a few of the possibilities are being suggested by the shape of developments now in process. Among these is the tightlock coupler for freight cars, the reduced slack in which promises an improvement in the ride of the car, and further development of the rubber draft gear for freight equipment.

The need has been the father of the ideas for the improvements which have been made in the past. The need for the future is for freight cars which are adapted primarily to meet the convenience of the shipper. This implies cars which will reduce to a minimum the amount of packaging expense to which he is subjected, cars which are convenient to load and unload and cars which reduce the amount of loss and damage for which the railroads will have to pay. These will determine the direction which changes will take in the future, as, indeed, they have already begun to take.

A & C Car Inspection Produces Results

There is nothing more essential to safe and efficient rail transportation than effective car inspection by competent car men who are well acquainted with all important details of their job and fully appreciate its importance. Probably little that is new can be said about A.A.R. freight-car standards and interchange rules, but the methods of interesting car-department personnel in these rules and giving both new and older men a more thorough understanding of rule application are always subject to experiment and sometimes major improvement.

An example is afforded by the A & C freight-car inspection system, not originated but now in use for over a year on the Gulf, Mobile & Ohio with quite satisfactory results. Speaking about train delays on this road due to hot boxes and mechanical defects, C. E. Lanham, superintendent of transportation, recently said: "The A & C inspection has materially improved this situation and we hope to do even better as time goes on. We are still working to reduce hot boxes, and have started a program to install waste retainers on all cars, which should further improve this condition."

Similarly C. M. House, general superintendent of motive power and car equipment comments, "The idea of this type of inspection (A & C) is to find defects on cars when empty and have the cars conditioned properly before being loaded. This method, while not fool-proof, has helped us to reduce car failures considerably." The typically conservative statements of these two officers are worth more than passing note.

Without attempting to describe the A & C car inspection system in detail, briefly it covers, in circular form, instructions for the inspection and repair of all freight cars at interchange points, shop tracks and transportation yards, as required by A.A.R. rules and I.C.C. Federal Safety Appliance laws. The A inspection is rigid and designed to detect all defects that can be found without dissecting the car. Any defects discovered are repaired before the car is again offered for loading, or if not feasible to make repairs locally, the necessary bad-order card is applied, dependent on whether the car is loaded or empty, and the car moved with suitable precautions to some shop point where repairs can be made.

The C inspection is intermediate and requires repairs or application of a bad-order card to any car found with defects or conditions which have developed in transit and made the car unsafe to operate. This inspection also covers examination of open-top cars to detect and correct shifted lading and make sure that published clearance dimensions are not exceeded.

Copies of the G. M. & O. bad order cards, certification card for commodity loading, report of improper repairs and car inspectors, original record are made a part of the circular mentioned which is printed on white paper, letter-head size, in large easily readable type. The inclusion of all general instructions regarding car inspectors' duties in a single circular sufficiently concise to be readily grasped and, in fact, almost committed to memory is a distinct achievement. It concentrates attention on fundamental points and is a great asset in the educational program which must be conducted on every railroad before desired results are secured in the way of improved freight-car inspection and maintenance practices.

Utilization Isn't Everything

An objection that has been raised against the adoption of the transit method for laying out steam locomotives has been that the instrument would be used such a small percentage of the time that its purchase could not be economically justified. In today's typical steam shop it may be used considerably less than a quarter of the time, and the fraction of the time that it will be used in the future is almost certain to decline with the reduction in the use of steam power.

Despite these drawbacks the transit method still shows promise of being one of the biggest, if not the biggest, sources of saving money in the maintenance of steam power. The instrument itself is cheap—one suitable for the layout of a steam locomotive should not cost over about 500 dollars. When a "tool" costs so little but can still make the drastic improvements in the wear of parts that the transit has shown itself capable of doing, it does not have to be used continuously, or nearly continuously, to have its purchase justified as would a machine costing upwards of five or ten thousand dollars.

Roads that are skeptical about the value of the transit in increasing mileage between repairs and reducing the maintenance cost can easily give the transit a trial without cost by the simple expedient of borrowing one from the engineering department. With a reasonable study of the procedures involved, care in doing the work and a mechanic of average competence on the job, it is almost inconceivable that an improvement in operation and a reduction in maintenance would not result from the trial. Even if the trial were a failure, which is highly improbable, no loss would be incurred. If it were a success, which is anything but improbable, a new and substantial means of reducing maintenance expense will have been found.

Where a road realizes the advantages of the transit method but hesitates to borrow or purchase an instrument because of a combination of both objec-

tions, it may be well to reflect on just how small the cost of a transit is compared to the money spent to maintain a locomotive between even one set of successive class repairs. If the transit aligns the locomotive only enough better to save one cent per mile in maintenance—a ridiculously low assumption in view of the results attained where the transit has been adopted—it will have paid for itself by the time the first locomotive on which it was used has run 50,000 miles. Future savings on this locomotive, as well as on any others laid out by the transit, will be clear profit, as will be the improvement in operation and the increase in availability.

How Long Should Coils Live?

Are traction motor armature coils subject to failure from fatigue? A good tight coil does not move radially or tangentially. Due to temperature changes it does have a small movement along the slot, but as compared with some mechanical part which is deflected constantly while in service, the coil is not subject to much stress or deflection.

Coils are now made of oxygen-free, high conductivity copper which has seven times the fatigue life of ordinary copper. Present-day insulation has excellent mechanical strength and it may be replaced and restored in quality by impregnating and baking or dipping and baking.

But the nose-suspended traction motors of Diesel-electric locomotives take a terrific beating. They are subject to shock, vibration, the effects of water and oil and abrasion from particles of ballast, dirt and sand. The relative effects of these several factors have not been determined and the lack of such knowledge is indicated by performance records.

Under some service and maintenance conditions, motors run up as much as 1,500,000 miles between rewindings. In other cases, they seem never able to go more than 300,000 miles. Such variations and uncertainty leave much to be desired.

Locomotive axles are changed out on an arbitrary mileage basis to avoid breakage of axles in service. Magnetic testing also serves to anticipate failure. More recently the Reflectoscope has come in to detect and locate progressive fractures before they become dangerous. Not only does this anticipate failure, but it allows axles to remain in service which otherwise would have been disposed of arbitrarily.

Were it possible to perform equivalent tests on armature coils, failure could be anticipated. This would be highly desirable, but under the present state of the art—should we have said science—it is more important to discover the reasons for the difference between 300,000- and 1,500,000-mile life.

There is some feeling of uneasiness among maintainers as to where Diesel maintenance costs may go, but the facts indicate that considerable improvements with corresponding reductions of costs are still possible.

NEW BOOKS

QUESTIONS AND ANSWERS ON 24-RL BRAKE EQUIPMENT. *Published by the Air Brake Association, Railway Exchange building, Chicago. 98 pages; paper bound, Price $2.50.*

This book describes the design and the functioning of the parts that make up this modern passenger and freight locomotive brake equipment by the use of a series of questions and answers. Approximately one-half of the book deals with descriptive material on the air supply system, the brake and feed valves, Rotair valves, control and relay valves. Twenty pages of questions and answers cover the various functions of the brake operation and the related charts, included in the book, show the equipment in the service and emergency positions. The remainder of the book describes the operation of the electro-pneumatic brake, overspeed protection, suppression feature, automatic train control, cab signal operation, dynamic interlock control, the functioning of the principal pipes and includes a series of questions and answers on procedure when pipes are broken.

HEATING, VENTILATING AND AIR CONDITIONING GUIDE. *1950 Edition. Published by the American Society of Heating and Ventilating Engineers, 51 Madison ave., New York. 1422 pages; Fabrikoid binding, Price $7.50.*

This is the 28th Edition of the Guide for 1950, in which there has been added 44 pages of new text material in the technical data section. A rearrangement of the 50 chapters has been effected in this edition by which the text has been grouped under seven general section headings. While all chapters have been revised major changes have been made in 23 of the 50 chapters. The material which deals with air conditioning systems used in the transportation industry has been placed under a single heading and this, like other text chapters, includes a bibliography of the related data on the subject of railway passenger car air conditioning. The Guide is an invaluable reference for those who are concerned with the problems of air conditioning and heating, whether in rolling stock or buildings.

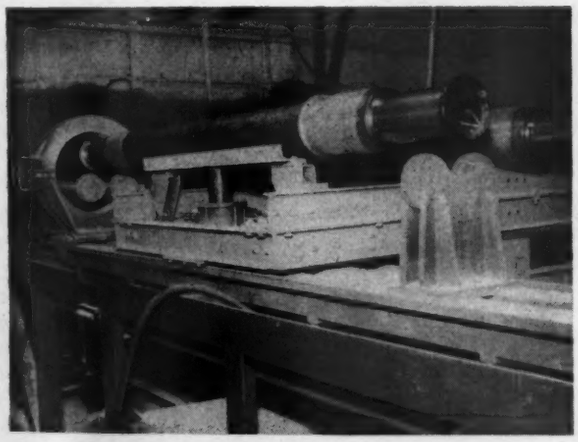
CAR INSPECTION AND REPAIR

Loading Axles on Magnaflux Machine

An axle loader which transfers axles from a burnishing machine directly to a Magnaflux machine has been developed at the Despatch Shops, Inc., East Rochester, New York. The storage rack on the loader is set at a slight downward incline from the former to the latter machine. The axles are placed upon the loader from the burnishing machine with a sling and roll by gravity to the end near the Magnaflux machine.

The axle nearest the Magnaflux machine comes to rest against stops at the end of the rack which place it directly over a lifting mechanism. The lifter is operated by two pairs of foot pedals. One pedal of the first pair controls a cylinder 3 in. by 3½ in. to raise the axle. The first pedal of the second pair actuates a double-acting cylinder 3 in. by 20 in. to move the axle directly over the rollers of the Magnaflux machine. Depressing the second pedal of the first pair exhausts the air from the vertical cylinder and lowers the axle on the rollers. The lowering rate for the axle is governed by an adjustable choke incorporated in the exhaust line of the cylinder. After the axle has been placed on the machine, the loader is returned to its original position by depressing the second foot pedal of the second pair, causing the horizontal double-acting cylinder to return the lifting mechanism to its original position.

The sling that lifts the axle is a channel section 5 in. by 2 in. by 3 ft. This is held parallel to the center line of the Magnaflux machine by two guide bars ¾ in. in diameter vertically mounted on the inside edges of the inclined storage rack. Grooved wheels ride on these bars as the axle is raised and lowered. Horizontal movement of the loader is on two pairs of four rollers each, two on top and two on the bottom to eliminate tipping.



The loader lifts the axle, moves it horizontally until it is directly over the rollers, and then lowers it on the rollers for Magnafluxing

A group of axles on the inclined storage rack ready for loading — The axle against the stops is directly over the lifting sling of the loader

Santa Fe Tests Causes of Hot Boxes

Tests were recently conducted by the Atchison, Topeka & Santa Fe to determine the value of packing retainers in preventing hot boxes by eliminating waste grabs. High-speed motion pictures were taken of journal boxes both with and without packing retainers, at the instant of impact during switching operations, and still pictures were taken of boxes after a road movement that involved no switching.

The motion pictures showed the extent of the movement and dislocation of the journal and bearing with respect to the journal box. This dislocation increased substantially the tendency for the waste to rise on the journal and to wedge between the journal and the bearing, thus constituting a waste grab. Where the boxes were equipped with waste retainers, this tendency was greatly reduced in both road and switching service.

Two different makes of packing retainers were tested for ability to hold the waste in place during switching impacts. The results with boxes so equipped were compared with those obtained from other journal boxes on the same side of the truck but which had no waste retainer. Photographs of journal boxes on cars in regular revenue freight service showed

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(1) High-speed motion picture of a journal box equipped with packing retainer taken at the instant of a switching impact at 10.7 m.p.h. The axle and bearing are seen to be displaced, and the waste has risen slightly but not sufficiently to approach the journal bearing

(2) A journal box equipped with packing retainer taken at the instant of a switching impact at 11.5 m.p.h. Again the journal and bearing are displaced, and the waste has risen, but not enough to cause a waste grab

3) The other box on the same side of the truck as the box in (2). This was taken after several impacts varying from 7 to 11.5 m.p.h. and shows how the packing is disarranged without a retainer

(4) Picture taken at the instant of impact at 7.7 m.p.h. of a non-retainer-equipped journal box. This was the third impact since packing (first two were 8.7 and 10.7 m.p.h.) and shows the waste touching the journal bearing

Photographs (5), (6) and (7) are of different cars in a westbound train going west over a hump at Argentine, Kan. These illustrate the condition of the packing as received after a 450-mile run in regular freight service with no switching involved since packing. The waste in each case has climbed on the rising side of the journal

Photographs (8) and (9) illustrate typical boxes in an eastbound freight going west over the hump. These boxes were serviced 215 miles away and had undergone no switching. The waste is under the brass in both cases, indicating that road impacts are as severe as switching impacts

that the impacts during normal road movement were comparable in severity to switching impacts.

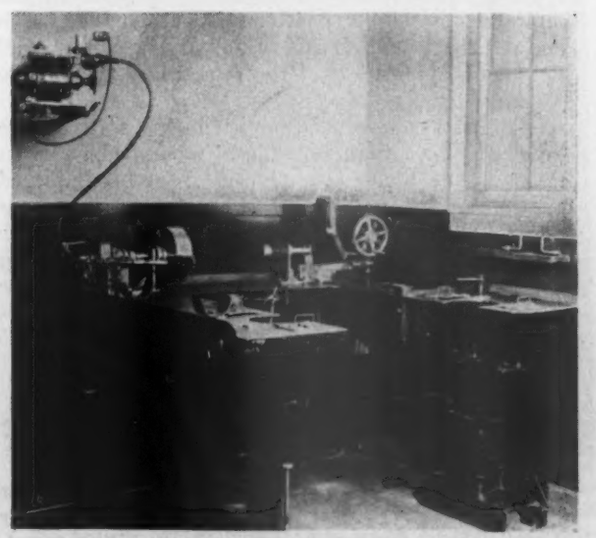
Figs. 1-4 show the effects of switching impacts on journal packing with and without retainers, which tests were made at speeds in excess of regular switching speeds to bring out the full effects of impacts. Figs. 5-9 illustrate the extent to which the packing climbs on the rising side of the journal during road freight movements. In these five illustrations the train had been completely serviced either 215 miles or 450 miles before the picture was taken and had not been switched from the time of servicing at the beginning of the trip to the time the picture was taken at the destination.

Compact Bench To Clean AB Cylinders

An exceptionally compact layout for cleaning AB cylinder assemblies and reconditioning all parts is in use at the Beech Grove, Ind. car shops of the New York Central. The arrangement not only saves shop space and unnecessary steps during the overhaul but it is equipped with numerous fittings and attachments to increase the efficiency of the cleaning and reconditioning of every part of a cylinder assembly. All the work done in reconditioning the assembly is done at the layout with the exception of cleaning the inside of the cylinder.

The pistons are taken from the storage space adjacent to the left leg of the U-shaped layout and the flange of the non-pressure head placed over an opening in the bench with the top restrained from upward movement by two slides on the top of the bench. The release spring is compressed by an air cylinder mounted to the lower part of the bench, and the hollow rod collar and its holding screws are removed. The piston is disassembled and small parts, such as cap screws and washers, the piston collar, the retaining plate, brass retaining rings, and the swab retainer ring are placed in a small wire basket about 5 in. by

The cleaning bench for AB cylinders, showing some of the devices which facilitate the cleaning and reconditioning of the individual parts



The cleaning bench with the various parts of the AB cylinder assembly in place on the various holding devices on which the parts are reconditioned

5 in. by 2 in.; the old swab is scrapped. The small basket with its parts is placed in a slot along one side of the main cleaning vat for the small parts to soak.

The piston is placed in a sleeve to hold it while removing the packing cup and the swab retainer ring, after which the excess grease is scraped from the piston. The tray into which the excess grease is scraped swings in a horizontal plane. It is mounted below the bench but is connected to a 6-in. handle by a shaft which extends through the bench. In this way the grease tray, which is 18 in. by 18 in. by 12 in. deep, can be swung into position for grease disposal or out of the way while other work is to be done. The piston is then placed in the main cleaning vat, 24 in. by 18 in. by 10 in., and, after the head has been cleaned in the solution, the bottom of the non-pressure head flange is buffed with a soft wire brush driven by an electric motor through a belt and flexible cable. Upon completion of the buffing, the non-pressure head is set under sliding clamps, which are located opposite the dis-assembly clamps, and the head left here until ready for re-assembly.

The excess grease is scraped off the packing cup into the swinging tray, and the packing cup cleaned in the large tray and stored on a wire rack until ready for re-use. The piston swab retainer ring is placed on a movable device on the top of the table to remove the swab, expander and retaining ring, which are scrapped, and to remove heavy grease from the grooves of the ring. The old felt is replaced, and the ring and a new felt are put in an oil bath directly across from the cleaning vat. This oil bath is a sliding drawer 15 in. wide, 6 in. deep and 12 in. high with a partition running down the center. The rear compartment of the bath holds the felt seal and the ring; the front, small parts for oil soaking.

The release spring is cleaned in the main vat and set on two circular rests about 20 in. apart until ready for assembly. The piston and rod are placed in a small lathe driven by an air motor, and the sleeve is smoothed off with emery cloth. The cleaned assembly is placed in a length of tubing welded to an opening in the bench near the assembly position. The tubing extends about 2 in. above the top of the bench and 10 in. below. It holds the pressure head and sleeve for application of the retaining ring and the packing cup.

The strainer screen is applied to the non-pressure head, and the non-pressure head is slipped on to an extension of the sleeve and the assemblage placed with the non-pressure head under sliding clamps for assembly. The release spring is compressed by an air cylinder for application of the felt seal ring and spring seat, and the hollow rod collar and screws. After the screws had been tightened with a brace the air is released and the job of reconditioning is complete.

Converted Mortise Machine

A mortising machine for which there was no further use at the New York Central Beech Grove, Ind. car shop has been converted into a grinder with a traveling work table. The work piece is moved back and forth under the grinding wheel by a hand feed wheel.

The feed on the grinding machine converted from a mortising machine permits the operator to apply sufficient pressure to the grinding wheel to take advantage of the full capacity of the 3-hp. driving motor

A second feed wheel moves the wheel in and out over the work piece; a third applies the wheel pressure to the work. In this way sufficient pressure can be applied to the wheel to make use of the full horsepower of the electric motor which drives the wheel.

Parts on which the converted grinder is used include brake levers, brake lever hangers, pedestal tie bars and journal box pedestal faces after the latter have been reclaimed by brazing.

The machine was converted by removing the existing belt-driven vertical feed and applying a hand feed. The horizontal table feed was left as on the original mortise machine. The grinding wheel installed is 2 in. by 5 in. and is belt-driven from a 3-hp. electric motor. The grinding wheel runs at 5400 r.p.m. and is hand fed for vertical and transverse movement. Other adjustments are made by movement of the table.

The grinding machine has an overall table length of 12 ft. and a total table travel of 12 ft. The table rides on two pairs of 10-in. wheels at each side of the grinder and on two intermediate pairs of 4-in. wheels in front of the grinding wheel.

Squeezing Rivets in Car Doors

With an arrangement in use at the Conneaut, Ohio, shops of the Nickel Plate, one man heats, applies and drives rivets in steel box or automobile car doors, grab irons, metal side ladders and miscellaneous small parts. The device consists of a permanently mounted pneumatic squeeze riveter, an oil heater and a jib crane with a hand chain hoist. The squeeze riveter is powered by an AB brake cylinder 10 in. by 12 in. and develops, through a leverage system, a pressure of 16 tons, giving it a capacity to drive rivets up to ¾-in. diameter.

The part or parts on which the rivets are to be squeeze-driven are fitted and reamed elsewhere, and delivered to the riveter with a few bolts to hold the components for inserting and driving the rivets. The rivets are heated to a cherry red in the oil heater adjacent to the riveter; up to six can be

applied at one time for driving without excessive cooling. To allow fine adjustment, the chain hoist is hand operated for supporting, adjusting and aligning the piece of equipment being riveted.

Adjustment for different thicknesses of parts to be riveted is made by changing the gap between the squeezing heads. This is done by mounting the rivet set on a threaded shaft which is operated by a hand wheel for raising the set up or down to open or close the gap. The rivet sets are adjustable for rivets from 3/8 in. to 3/4 in., with the different sets secured with keys to the piston rod extension and to the threaded shaft.

The jib crane on which the hand chain hoist is

Arrangement for one man to heat, apply and drive rivets with a squeeze riveter

mounted is an I-beam section made from welding two 5-in. channels together. The crane has a radius of 10 ft. and swings in a full 360-deg. arc. The hand chain hoist is suspended from the boom by a four-wheel trolley.

Operation of the riveter is by foot pedals. Depressing a pedal applies the air pressure to drive the rivet; releasing the pedal releases the air and allows the piston to be returned to starting position through a spring. A stop is incorporated in the leverage between the air piston and the rivet head die to prevent over-travel.

Passenger Car Spring Depressor

Spring plank hanger bars and spring plank hanger bearings are removed from or applied to passenger car trucks equipped with helical bolster springs by means of a spring depressor developed at the New York Central Beech Grove Ind. car shops. The depressor is powered by a 50-ton jack and can be used on most any car truck with coil bolster springs.

To disassemble the truck the brake rigging is removed and the jack and bridge placed across the top of the truck frame. The crosshead with the tension rods is picked up with the crane and set on top of

Compressing a set of helical bolster springs with the spring depressor

the jack with the tension rods extending through the cored openings in the truck bolster and the spring plank. The bottom seats of the depressor are applied below the bolster and secured at the bottom of the tension rods with steel keys, which are applied through slots in the bottom of the tension rods.

The springs are compressed by raising the shaft of the jack by an air motor, which drives the jack through a worm gear attachment. Raising the shaft of the jack lifts the tension rods and the bottom seats attached to the rods, thereby compressing the springs, as the base of the jack is held in a fixed position on the bridge which lies across the tops of the side frames.

After the springs are compressed, the spring plank hanger bars are removed and the springs released from compression by reversing the air motor. When the truck is to be reassembled, procedure is reversed.

The depressor for car trucks equipped with coil bolster springs, showing the vertical tension rods, the seats on the bottom of the tension rods which fit under the bolster, the jack and the bridge which fits across the top of the truck frame

QUESTIONS AND ANSWERS

The question and answer department is included for the benefit of those who may desire assistance on problems involving matters pertaining to the operation or maintenance of air brakes, Diesel-electric locomotives, steam locomotive boilers or steam locomotive practice. Any inquiry should bear the name and address of the writer, whose identity will not be disclosed unless special permission is given to do so. Anonymous communications will not be considered. Inquiries addressed to this publication will be referred to the source from which authoritative answer can be secured.

Diesel-Electric Locomotives

Steam Generators*

Q.—What would happen to the output of a boiler if a leak would occur in the suction line from the water tank to the treatment tank?

A.—The Vapor generator depends on a tight water suction line. If the water suction line has a leak, the water pump will not give full delivery, and the output of the boiler will be cut down in direct relation to the amount of water that is being lost through the suction leak. With an above-deck tank you will have some water splashing around on the floor and it won't bother the steam generator a whole lot, but if it's a below-deck tank you're in for trouble and you might even run to the point where the generator will shut down because of a superheated steam condition. The extent of actual loss would depend on the water volume loss which has taken place because of the air leak.

Q.—Will piping the by-pass water from the water by-pass regulator into the water-return line instead of into the suction side of the pump eliminate the blowing off of the treatment tank cover?

A.—That's a controversial subject. You can't have two states of physical condition taking place in one vessel and that is the condition that will take place if you were using a water pump to pump water into a line and return all or part of that water back into the suction side of the pump.

With the water pump working putting some of the water into the boiler coils and by-passing some of it into the suction side of the pump you have, on the suction side, a different pressure than on the pressure side. And you also have atmospheric pressure working on the top of the water storage tank. You have a suction on the inside of the tank and the atmospheric pressure plus the fastening of the tank cover on the outside of the tank so that the tank cover won't come off by itself. Where the cover has come off, we have traced it to defective check valves. This condition takes place when the boiler shuts down, or cycles off. When the boiler check valve leaks, the steam pressure on the water in the coils of the boiler works back through the various controls and through the valves of the water pump into the treatment chamber. It requires about 40-lb. pressure to blow the top of the treatment tank off. With that backup of pressure the top of the treatment tank comes off, the pressure is relieved and usually by the time that anybody gets to the point where the trouble has occurred, all the steam pressure has gone off the generator, so the logical thing to believe would be that the water pump itself has created a state whereby you have a suction and a pressure combined in one vessel. Vapor advocates removing the return water line from the suction side of the pump and putting it back into the water storage tank direct or into the water return line leading to the water storage tank.

Q.—What is the matter with DRK and the OK refractories that appear hard on original application but are chalky and break easily at the first inspection?

A.—Some run for years, and some run for a few weeks. The refractory is subject to intense heat. One cause of a refractory failure is improper oil spray, that is, the spray breaking up the fuel. If fuel is sprayed in a particular section of the refractory where it's not all burned, the fuel which is penetrating the refractory goes through the pores and finally you get some surface combustion, but mostly vapor is formed under pressure in the crevices which causes the refractory to have a crumbly appearance. Sometimes somebody gets some fire brick clay and spreads it over the top and that firebrick clay takes on a checked appearance for which the refractory is blamed. Sometimes that firebrick clay has a reaction that lowers the melting or fusing rate of the refractory; and that causes refractory breakdowns.

* These questions and answers were submitted following a talk at the December meeting of the Chicago Railroad Diesel Club by M. Sudheimer of Electro-Motive.

Q.—How many cars can be safely heated in extremely cold weather by one 3,000-lb. generator?

A.—Under ordinary conditions, 10 cars down to five below zero in ordinary weather.

Q.—What causes hot domes?

A.—The heat, instead of going down and then out through the stack, gets up in the primary combustion chamber. Some models do not have radiant baffles. Primarily, the cause of hot domes is due to either a dirty blower fan; too much fuel for the amount of combustion air available; the nozzle being in an improper position; loose blower belts; coil flues full of carbon which hasn't been cleaned out in some time; or a damper sticking on low fire.

Q.—In case of a spark failure would you recommend lighting a fire with a fusee? If so, what procedure would be used?

A.—I have on occasion taken a piece of rag, dipped it in some fuel oil, shut the generator down, taken the peepsight glass off, ignited the rag, dropped it down in the bottom and started the generator going; and I regulated the generator manually so it would continue to fire and if it exceeded the set pressure it would go on up and pop the safety valves and keep on running until we got into a place where we could correct the cause of the trouble. Do not use a fuse because you may jam the nozzle off to one side getting it in or bend the spark plugs.

Steam Locomotive Boilers

Which Way Is Best?

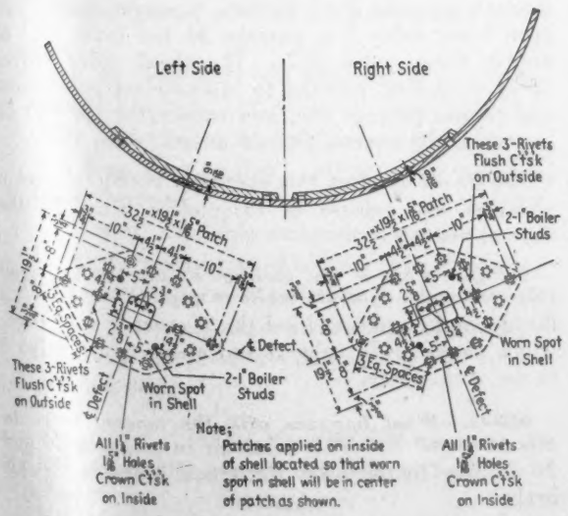
Q.—Our tube and flue setting practice is to roll in the tubes with straight roller expander, flare and bead the tubes, then weld between the bead and the flue sheet. We have been informed that some roads bevel the edge of the tube hole in the sheet, flare the tube into the bevel and weld. Would this method be any improvement over our present practice?—V.L.W.

A.—Beveling the edge of the tube hole and flaring the tube into the bevel might seem to be advantageous from the viewpoint of holding the tube. The disadvantage would be due to the reduction in the thickness of the tube sheet at the point where the tubes are worked, also the bevel edge would reduce the cross-sectional area of the metal through the budges, resulting in cracked budges. Of the two methods present practice is the most satisfactory.

Repairs to Welded Boiler

Q.—In the January Issue of* Railway Mechanical and Electrical Engineer *you state that welding is not permitted to repair a crack in the outside throat sheet of a locomotive boiler, also that welding is not permitted on any part of a locomotive boiler where the strain to which the structure is subjected is not carried by other construction. Would this ruling apply to an all-welded locomotive boiler when the longitudinal and circumferential seams of the shell are welded?—R.M.P.

By George M. Davies


Left Side
Right Side
These 3-Rivets Flush C'tsk on Outside
2-1" Boiler Studs
Worn Spot in Shell
Defect
All 1⅛" Rivets 1⅜" Holes Crown C'tsk on Inside
Note; Patches applied on inside of shell located so that worn spot in shell will be in center of patch as shown.

A.—Repairs to the shell of an all-welded boiler should be made in accordance with the established practices for riveted boilers and defects in the shell of such boilers should be repaired with patches of riveted construction.

The drawing shows a patch applied to the second course of an all-welded shell, the defect was caused by a spring hanger rubbing the shell course wearing into the shell course $\frac{9}{16}$ in. deep.

The patch is a typical diamond shape patch having an efficiency equal to the efficiency of the welded longitudinal seam. The patch being applied on the inside of the shell because of the limited clearance between the driving spring hanger and the shell.

Life of Smokeboxes

Q.—What is considered the average life of the smokebox of a locomotive boiler? Is cinder cutting the cause of the greater number of smokebox renewals? —F.E.B.

A.—The average life of a smokebox varies from twelve to twenty years as is usually renewed account of pitting and corrosion from chemicals of sulphuric acid nature, particularly at the bottom of sheets formed from collection of cinders and moisture or condensation from leaks from the various appurtenances in the front end, also cinder cutting due to high velocity of forced draft.

On modern locomotives having multiple throttles and feed water heaters recessed into the smokebox, the original rigidity of the smokebox was impaired, so it was necessary to reinforce the smokebox with liners extending up to the center line of the boiler.

Thickness of Shell Patches

Q.—In applying boiler patches it is our practice to make the patch the same thickness as the shell course to which it is applied and I have been given to understand that all patches must be the same thickness as the shell in order to be approved by the I. C. C. —M.E.R.

A.—It is not necessary that the thickness of the

patch be the same as the thickness of the boiler shell course to which it is applied, provided the efficiency of the patch is at least equal to the efficiency of the longitudinal seam. However, it is good practice to make the patch the same thickness as the shell course, because the efficiency of a well-designed diamond-shaped patch is usually obtained along the outside diagonal row of rivets. This efficiency would also be the efficiency of the shell course along this row of rivets, and for this reason the allowable working pressure on the patch, based on the efficiency along the diagonal row of rivets, would also apply to the shell course provided the thickness of the patch and the shell course were the same.

Schedule 24RL Air Brakes

Electro-Pneumatic Brake Operation—*Continued*

944-Q.—What movement results from this difference in pressure between chambers A and B? A.—The pressure in chamber *A* now being higher, diaphragm *18a* is moved towards the left taking shaft *32* and contact lever *41* with it, and the release (Rel) contact opens to de-energize the release wire and therefore the release magnet of the No. *21-B* magnet valve.

945-Q.—What results from the release magnet being de-energized? A.—Spring *35* then unseats release magnet valve *62* of the No. *21-B* magnet valve, opening the exhaust so that pressure from passage *4a*, the straight air pipe and the relay valve, is reduced the same amount that control pipe *11* reduces.

946-Q.—How is a graduated release obtained at the relay portion? A.—In making a graduated release, the relay portion will lap and retain brake cylinder pressure in accordance with the lapping action of the master controller so that the brake cylinder pressure can be released in small increments to produce a smooth stop.

947-Q.—With the brake valve shifter in straight air position, is an automatic emergency application available? A.—Yes, by moving the handle of the brake valve to its extreme right position.

948-Q.—How is the emergency application obtained? A.—In this handle position emergency valve *241* and its pilot valve *243* are unseated by a cam on the brake valve handle shaft, allowing air from passage *1* and the brake pipe to escape rapidly to the exhaust, Ex. This provides an emergency rate of brake pipe reduction to produce an automatic emergency.

Independent Bbake Release After an Electro-Pneumatic Application

949-Q.—Is it possible to release an electro-pneumatic application on the locomotive independently? A.—Yes, by depressing the independent brake valve handle in Release position.

950-Q.—Is it necessary to keep the handle depressed to effect a release? A.—Yes, if the handle is released, the locomotive brakes will re-apply.

951-Q.—What must be done in order to hold the locomotive brakes off during an electro-pneumatic brake application? A.—The independent brake valve handle must be placed in lock-down position.

952-Q.—With the independent brake valve handle depressed, how is the release of an electro-pneumatic brake application obtained? A.—As previously described under independent release after an automatic application, main reservoir air is admitted to the actuating pipe *13* and flows to the control valve to chamber *G* on the face of piston *237*. The piston moves upward carrying slide valve *226* with it. The slide valve cuts off electro-pneumatic application air from passage *8* and the straight air pipe from the relay valve.

953-Q.—What then happens? A.—Passage *16* air from the top of the quick release check valve *287* is connected to the exhaust.

954-Q.—How does the FA-4 magnet valve in connection with the Dynamic Brake Interlock Portion, function? A.—It is used to release or prevent an automatic or electro-pneumatic brake application on the locomotive if the dynamic brake is on.

955-Q.—How does this affect the independent application and release operation? A.—Independent application and release of the locomotive brake is available at all times.

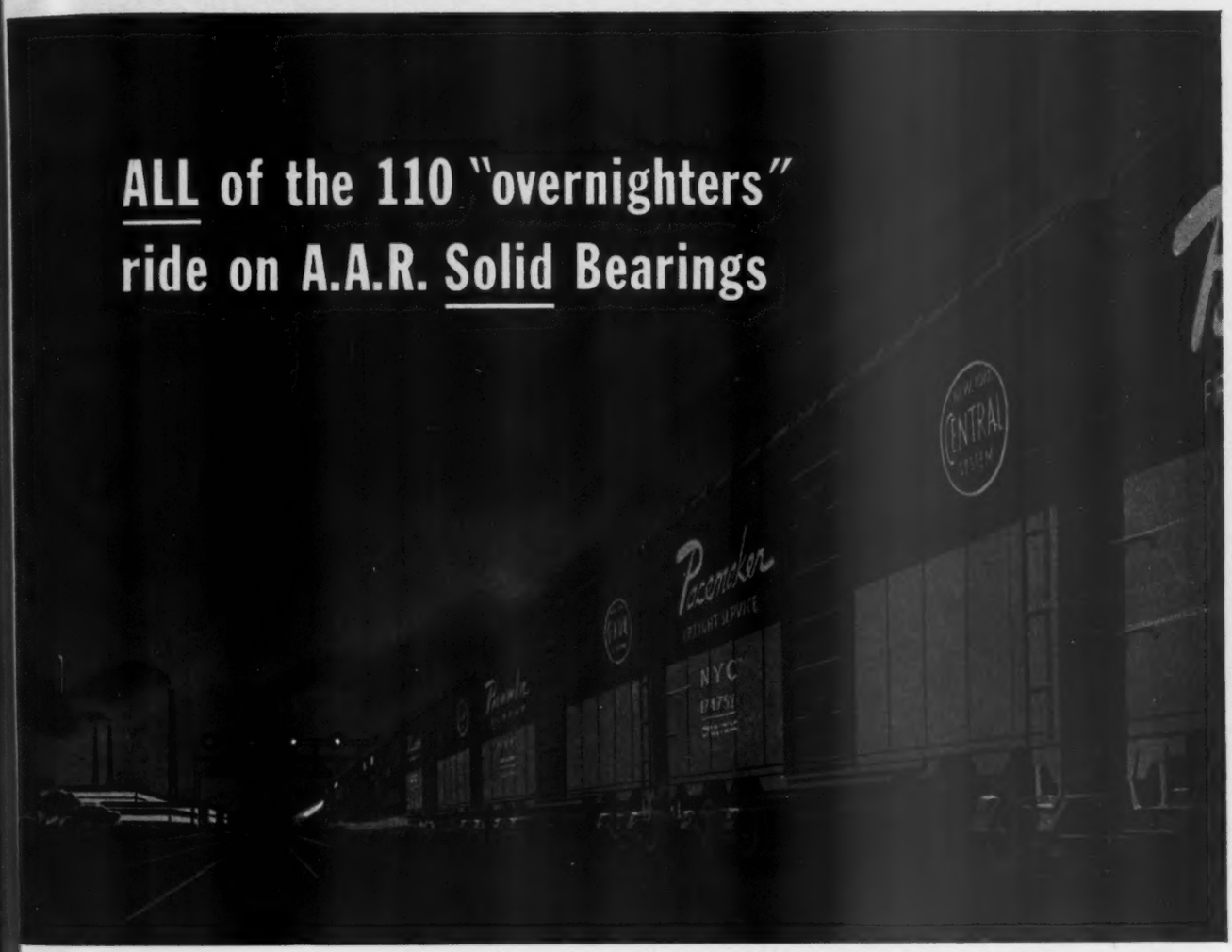
956-Q.—What happens when the FA-4 magnet valve is de-energized? A.—With the magnet valve de-energized (Dynamic Brake off) upper valve *3* is seated, lower valve *3* is open.

957-Q.—Describe the flow of air during an automatic or electro-pneumatic application. A.—Air flows through passage *3* or *8a* into passage *28* through open lower valve *3* to passage *36* and lower end of double check valve *252c*. The check valve moves upward, closing passage to independent application and release passage *20a*, and connecting passage *36* to passage *16*, control pipe *16* and the relay valve.

958-Q.—What does this operation permit? A.—Application and release of locomotive brake in the normal manner.

959-Q.—What is the position of the FA-4 magnet valve when the dynamic brake is applied? A.—With the dynamic brake applied the magnet is energized, which closes lower valve *3* and opens upper valve *3* to the atmosphere.

960-Q.—What happens with the magnet valve in this position? A.—This vents air in passages *36* and *16* leading to the relay valve and releases the air brake.



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LIGHT WEIGHT: Saves more than 100,000 lbs. dead weight per hundred-car train.

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Home of the Diesel Locomotive

NEW DEVICES

Workholding Tool

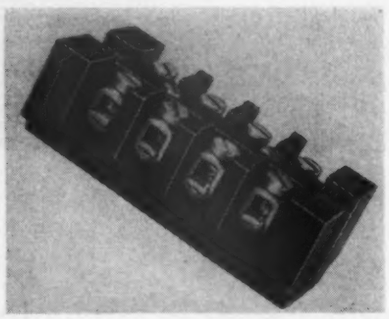
In-R-Tool is a work-holding device that can be used in lathes, vises, boring mills, on machine tables and in fixtures, as well as in electric drills and drill presses to reduce set-up time. It is an inner pressure tool with a number of applications, but is primarily an expanding arbor. Cores and pressure members that fit the splines of the cores, are interchangeable with a range from 1¼ to 2¾ in. A ratio-limiting collar controls the distortion of thin work. This collar regulates expansion of the pressure members, which in turn hold the work firmly and accurately in place.

The In-R-Tool can be used as an expanding arbor when working between lathe centers or when used in chucks or collets. When used in an electric drill or drill press, it permits removing a few thousandths of a bushing to get a fit. On milling machines and other machine tables, the tool can be used as a jig, or part of a jig. When used as an anchor, it acts as an inside, self-centering chuck. In welding shops, the tool aligns the interior and exterior of pipe or other objects that have to be aligned on the inside as well as the outside.

The In-R-Tool is a product of the Layne-Held Corp., 2007-L South Shelby street, Higginsville, Mo.

Solderless Terminal Blocks

A solderless type Bepco molded terminal block now being made by the Buchanan Electrical Products Corporation, Hillside, N. J., eliminates need for wrapping wires around studs or applying terminals to wire ends as is the case with conventional screw type blocks. The Bepco terminal blocks are provided with compression type solderless units, each capable of receiving wires from No. 16 to 6 A.W.G. Typical combinations which may be accommodated by a single terminal are two



No. 10, two No. 12 or two No. 14; one No. 12 with one No. 10, one No. 12 with one No. 14, etc. Attachment of wires to the block is accomplished by merely tightening screws after insertion of stripped wires. The block allows more rapid production wiring and lends itself to easier and quicker maintenance. The blocks are rated at 35 amp., 600 v., and are available in 4, 8 and 12 circuit sizes. Screw-on covers are available.

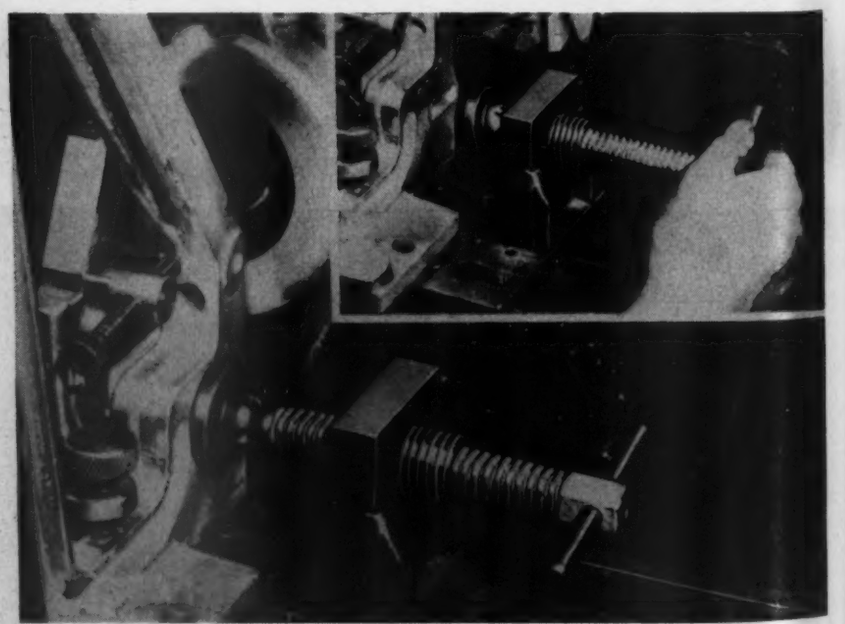
Quick-Action Work-Holding Units

Mechanics Engineering Company, Inc., Jackson, Mich., has announced a redesigned line of work-holding units of a positive quick-acting type, under the brand name of Bar-Lok, for use in jigs and fixtures, and for positioning in machining, welding, brazing, plastics and wood working, and for assembly jobs. With these units, the usual screw action is eliminated for clamping and releasing the work.

This is accomplished through the use of a radially-grooved square pressure bar which slides freely through a threaded collar when turned toward the left (counter-clockwise) against a stop. In this position, the foot of the bar is placed against the work instantly, from a full-open position. The bar is then turned toward the right (clockwise), which brings it into engagement with the threaded collar, thus applying screw pressure against the work. To release the work, the bar is turned toward the left, releasing the screw pressure and causing the bar to re-enter the free-sliding position, in which it is instantly drawn away from the work.

The Bar-Lok units are available in three series to meet variations in pressure requirements and to provide a range of lengths up to 12 in. There is a choice of tee or swivel handles, and of square, round or flexible feet. All parts are made of hardened steel, cadmium-plated, for long life in high-production service and resistance to corrosion.

For simply clamping, a line of medium-duty Bar-Lok pressure units in especially adapted C-clamp frames, is offered and, for application to jigs and fixtures, an internal-threaded adapter which may be bolted, welded, or brazed into position.



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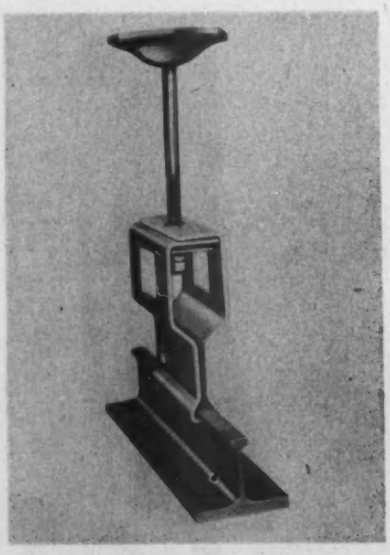
Light-Section Monorail System

A Trambeam monorail materials-handling system, specially designed for economical overhead handling of light loads or short spans, has been announced by the Whiting Corporation, Harvey, Ill.

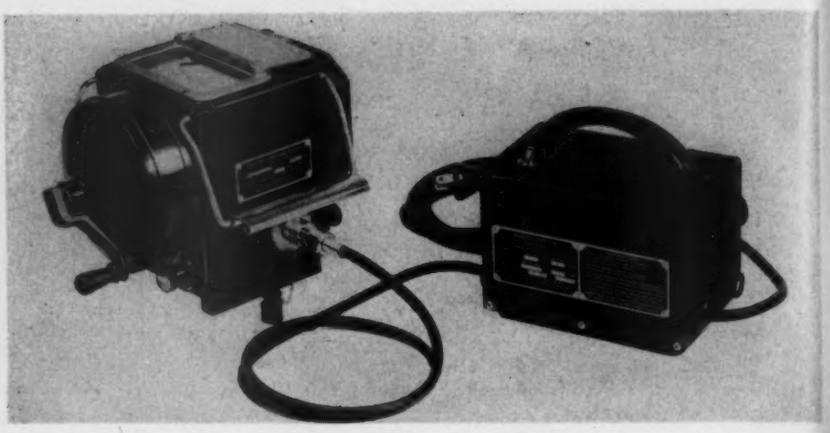
Called the T-Beam Trambeam, the new system is interconnectable with the conventional Trambeam and offers the advantages of those heavier systems within its range. It consists of a one-piece rail section which has a flat tread and is made of high-carbon steel to provide extra strength without extra weight. The rail and its hangers are flexibly suspended to eliminate torsion on the hanger rods, and to equalize wheel loads.



Hand-Crank or Rectifier Insulation Tester

A hand-cranked Meg type of Megger, manufactured by the James G. Biddle Co., Philadelphia 7, Pa., is now available in a combination hand-crank and rectifier-operated set. It consists of the Meg type constant-pressure test set and a separate rectifier which supplies 500 volts d.c. from any 115-volt a.c., 60-cycle outlet. One cord from the hand-crank instrument and another from the rectifier to an a.c. outlet eliminates hand operation.

This dual-operated instrument is expected to have its most important applications in communications and in extensive cable wiring and control installations where a great many tests are to be made, and where an a.c. outlet is readily available. It is particularly well suited to applications in which continuous operation of the instrument is desired, as in observing dielectric absorption effects in various types of electrical equipment.



The availability of the hand-cranked instrument, without the rectifier, makes it particularly attractive to those who would use it in the field.

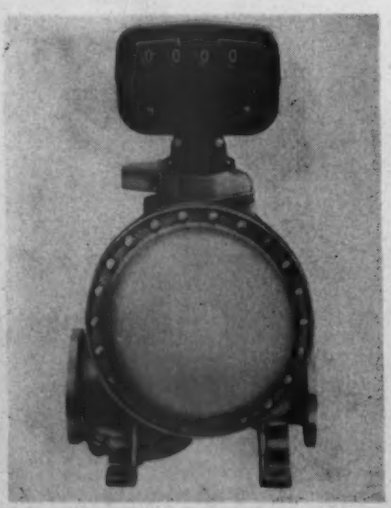
Positive Displacement Rotary Fuel Meter

The illustration shows a positive displacement bi-rotary meter, which will find application in the rapid fueling of Diesel locomotives. The unit is a development of the Ralph N. Brodie Company, Oakland, Calif.

The device, named the BiRotor Meter, is said to embody many features which contribute to high precision of sustained accuracy and trouble-free service. Simplified construction of the meters includes a complete interchangeable measuring unit, comprised of two synchronized, helical rotors, which freely rotate in static and dynamic balance under all operating conditions.

This sub-assembly measuring element is securely mounted within a steel meter housing. It can be readily removed, when required, for inspection or centralized bench servicing, without disturbing existing line connections. No complex reciprocating parts to wear out or cause trouble are employed.

These meters can be equipped with distance-spanning, direct reading counters; with automatic quantity shut-off controls, and with smooth, shockless gallonage ticket printers.



Angle-Head Open-End Wrenches

Snap-on Tools Corporation, Kenosha, Wis., has announced a series of angle-head wrenches designed for close-quarter work. They are forged from alloy, high-carbon steel.

The heads of these wrenches are set at different angles—one 30 deg. and one 60 deg.—to the handle. As both heads on each wrench are the same size, switching ends permits turning nuts in narrow swing areas. Thin heads—only ¼ in. on the largest size—means clearance problems are practically eliminated.

Other features include rounded handle edges that are comfortable in the hand, pear-shaped heads which simply use in close-quarters while giving extra wall strength at the point of greatest strain, and a rust-proof double-plated finish of nickel and chrome over the entire tool. Four wrench sizes are available with openings 7/16, ½, 9/16 and ⅝ in.

Indoor Current Transformers

Indoor, Type MR current transformers for low-voltage metering indoors with or without thermal demand meters are available from Westinghouse Electric Corporation. The new transformers have high accuracy with ASA class 0.3 at burden B-0.1 and a continuous current rating of

Hardened Tool Steel Vees

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protect the carriage ways of
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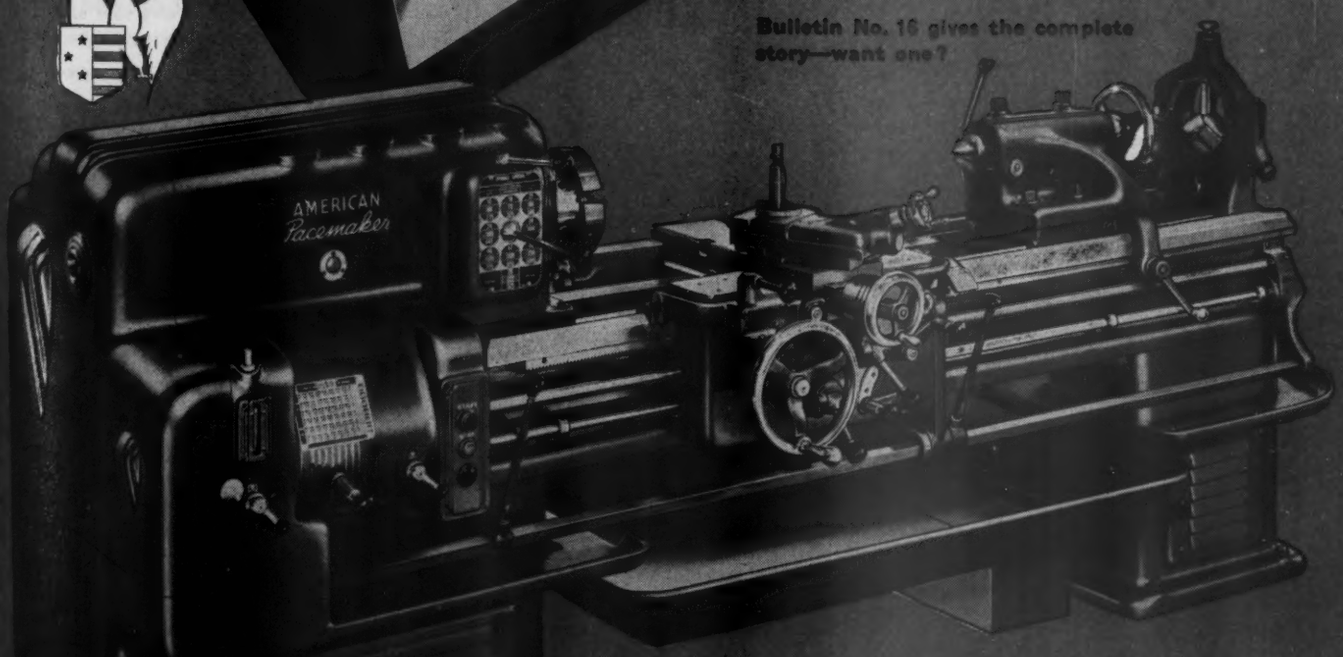
These hardened vees are made of solid tool steel and ground to gauge tolerances for interchangeability should replacement ever be required.

After hardening, the metallurgical structure is stabilized by cold treatment at minus 108° Fahrenheit to prevent twisting or warping.

This feature is but one of the outstanding advantages offered by the new "AMERICAN" Pacemaker Lathe.

Bulletin No. 16 gives the complete story—want one?



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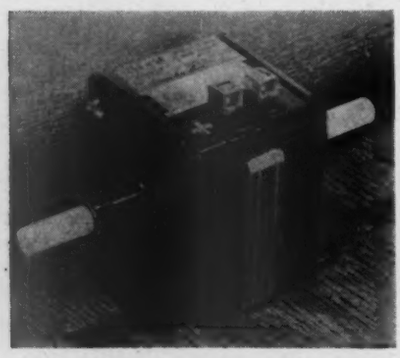
200 per cent while not exceeding a temperature rise of 55 deg. C. Accuracy is maintained over this entire current span so that only two current transformers, of 200- and 400-amp. ratings, are required to meter in the complete range from 10 to 800 amp. Use of grain-oriented Hipersil in the core reduces weight and dimensions to a minimum.

The transformer is mounted in a compact metal case with Moldarta cover and a removable, silver-plated primary conductor. Secondary terminals are mounted on phosphor bronze supports and have solderless connectors that will accommodate No. 6 to No. 14 conductors. No short-circuiting device is used since the open-circuit secondary voltage under full load is only approximately 100 volts. The transformers are designed for operation up to 600 volts with primary current ratings of 200 or 400 amp. to 5 amp. A three-wire transformer is also available with a ratio of 200-300 to 5 amp.



Selective Speed Gearshift Drive

The illustrated drive unit designated as the Type R3C, features a combination integrally mounted electric motor and a four-speed transmission having both primary and secondary gear reductions. This unit can fill the need for a compact drive in providing low, multiple-output speeds. It has been made available by The Lima Electric Co., Lima, Ohio.

The gearshift drive delivers full rated horsepower in each of the four speeds and, both constant-torque and constant-horsepower two-speed motors are available on these units.

Some of its many applications will be found in the individual motorization of automatic screw machines, drag conveyors, mixing equipment and installations where a low range of selective speeds, with high radial load capacity are required.

These drives are designed for operation on polyphase, a.c. power supplies on standard frequencies including 25, 50 and 60 cycles and voltages below 600.

They have primary selective gear ratios of 4.15, 3.15, 1.85 and 1 to 1.

Revolving Die-Head Pipe Threaders

A new line of Tom Thumb, portable 2-in. capacity threading units is now available from the Oster Manufacturing Company, Cleveland, Ohio.

Two models, Nos. 582 and 582-R, are designed primarily for threading pipe from ¼ to 2 in. standard range; extra range ⅛ in. pipe; extended range with drive shaft 2½ to 8 in. Both models have a bolt range of ¼ to 1½ in. Two other models, Nos. 581-A and 582-A, are made for threading bolts from ¼ to 1½ in. No. 581-A has a pipe range of ⅛ to 1¼ in., pipe range of No. 582-A is ¼ to 2 in.

Although basically similar in design and construction, each of the four units has features which meet individual requirements.

Model 582 is furnished with two stationary die-heads and a wrenchless chuck. It is designed for threading straight pipe or conduit and bolts. No. 582-R, furnished with a manually operated revolving die-head and open-type vise, is designed for threading bent as well as straight pipe, conduit and bolts.

Each bolt machine, Nos. 581-A and 582-A, is equipped with fully automatic revolving die-heads and open-type vise for threading bent and straight bolts, rods, pipe, studs, etc.

All four models have ½ hp., 7,500 r.p.m. motors. Other identical features include hardened worms and bronze worm gears driven by 2 Vee belts through back gears.

Spindle speeds of each unit are as follows: No. 582—30 to 65 r.p.m.; No. 582-R—25 to 50 r.p.m.; No. 581-A—47 to 105 r.p.m., and No. 582-A from 30 to 65 r.p.m.

Centerless Grinder Blade Tips

A newly developed Colmoney centerless grinder work rest blade tip said to prolong wear life eight times over that of high-speed tool steel has been made available by Diamond and Tools, Inc., 19345 John R. st., Detroit 3, Mich.

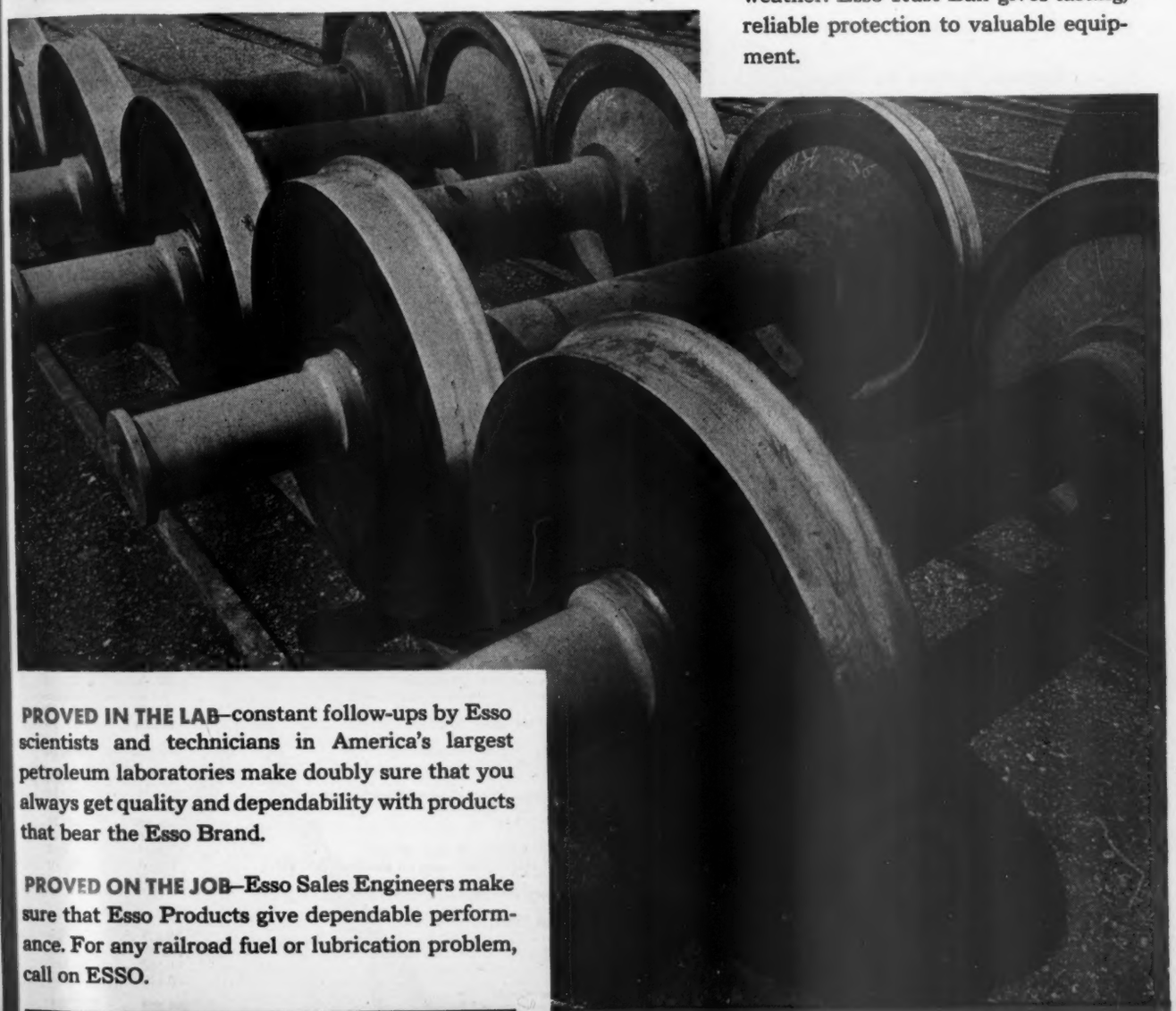
These tips can be silver-soldered to present blades at less cost than purchasing new ones made from high speed steel. Further, if an entire new blade is required it can be constructed from ordinary mild steel reducing cost considerably. Whatever type of blade is used as a foundation for the tip, it can be used over and over indefinitely by merely retipping when necessary.

Comparing these tips with tungsten carbide inserts they have the important advantage of greater shock resistance. Although the wear life is slightly less than carbide, the low price and ease of grinding makes them economical on most applications.

Month after month

ESSO RUST BAN—provides a highly efficient, protective coating for stored railroad equipment such as anti-friction journal bearings, axle journals, and diesel engine parts.

PROVED IN USE—on parts stored outside for long periods, in all kinds of weather. Esso Rust Ban gives lasting, reliable protection to valuable equipment.



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NEWS

Second Fireman on Diesels Out in May 16 Strike Settlement

A six-day old strike of railroad firemen against all or parts of four major railroad companies was brought to settlement at about 3:30 a.m. on May 16 after an all-night mediation session in Chicago. According to a joint statement issued by the railroads shortly after settlement had been reached, "The major issue in the dispute was resolved by the union's withdrawing its demand for a second fireman on multiple-unit Diesel-electric engines, and the railroads' agreeing to arbitrate the union's charges that certain practices in connection with the operation of these engines were in violation of existing contracts."

"While two fact-finding boards cleared the carriers of these charges," the railroad spokesman said, "we have agreed to go before a third board—an arbitration board—whose decision is to be binding on both sides.

"If it should be found as the result of this third hearing that any of our operating practices are not in accordance with our agreements with the firemen, the individual railroads are free to adopt whatever corrective measures they deem appropriate.

"The only other manpower issue involved in this dispute," according to the railroads' statement, "was the demand of the union for a fireman on about 20 small, 'teapot' Diesels used in switching service, mostly in small isolated yards." Where a fireman is presently employed on these switches the railroads have agreed that he shall be retained. As to the others now in service, the need for a fireman will be submitted to an arbitration board. Other issues involved in the dispute were of minor character and easily adjusted."

I.C.C. to Get Reports On Bad-Order Situation

By Service Order No. 849, the Interstate Commerce Commission has directed its Bureau of Service to obtain, effective April 15, semi-monthly reports on the number of unserviceable freight cars in excess of 5 per cent of car ownership which are held for repair on Class I roads. The reports, which will continue through August 15, will be furnished to the I.C.C. by the Car Service Division, Association of American Railroads. In addition to cars being held for repair, each report will show the number of cars repaired in the preceding semi-monthly period and the number programmed for repair in the ensuing period.

The service order was issued by the commission on April 14. The increasing shortages of freight cars, particularly in the west, and the "materially increased" number of unserviceable cars have created an "emergency" situation, the commission said.

Homer C. King, who as director of the Bureau of Service will handle the semi-monthly reports, said the number of bad order cars on March 1, 1950, was 52 per cent higher than the same date a year ago. He said most recent figures "indicate an effort to step up repair programs," and added that, according to Car Service

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of January 1950	1949
3	Road locomotive miles (000) (M-211):		
3-05	Total, steam	27,338	38,477
3-06	Total, Diesel-electric	15,260	10,842
3-07	Total, electric	765	930
3-04	Total, locomotive-miles	43,364	50,250
4	Car-miles (000,000) (M-211):		
4-03	Loaded, total	1,370	1,566
4-06	Empty, total	794	876
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):		
6-01	Total in coal-burning steam locomotive trains	40,985	59,429
6-02	Total in oil-burning steam locomotive trains	10,268	15,146
6-03	Total in Diesel-electric locomotive trains	41,764	30,251
6-04	Total in electric locomotive trains	1,987	2,381
6-06	Total in all trains	95,010	107,212
10	Averages per train-mile (excluding light trains) (M-211):		
10-01	Locomotive-miles (principal and helper)	1.05	1.06
10-02	Loaded freight car-miles	35.20	33.90
10-03	Empty freight car-miles	20.40	19.80
10-04	Total freight car-miles (excluding caboose)	55.60	53.70
10-05	Gross ton-miles (excluding locomotive and tender)	2,440	2,416
10-06	Net ton-miles	1,073	1,109
12	Net ton-miles per loaded car-mile (M-211)	30.50	32.70
13	Car-mile ratios (M-211):		
13-03	Per cent loaded of total freight car-miles	63.30	63.20
14	Averages per train hour (M-211):		
14-01	Train miles	17.20	16.50
14-02	Gross ton-miles (excluding locomotive and tender)	41,371	39,420
14	Car-miles per freight car day (M-240):		
14-01	Serviceable	38.90	41.30
14-02	All	36.10	39.40
15	Average net ton-miles per freight car-day (M-240)	697	815
17	Per cent of home cars of total freight cars on the line (M-240)	50.90	46.90

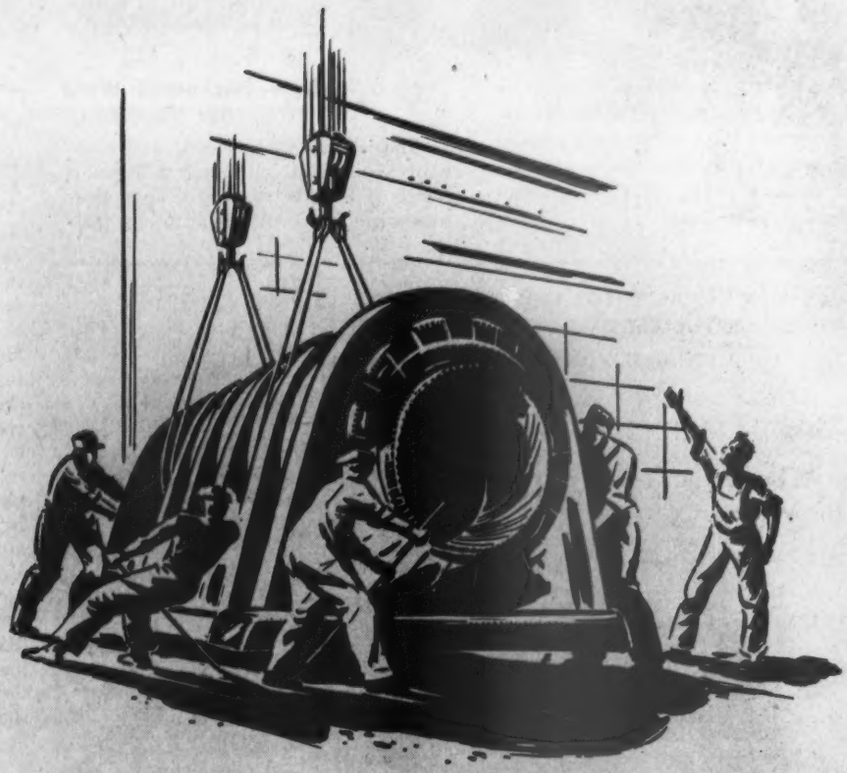
PASSENGER SERVICE (DATA FROM I.C.C. M-213)

3	Road motive-power miles (000):		
3-05	Steam	12,376	18,835
3-06	Diesel-electric	14,120	11,717
3-07	Electric	1,662	1,816
3-04	Total	28,159	32,385
4	Passenger-train car-miles (000):		
4-08	Total in all locomotive-propelled trains	269,272	298,449
4-09	Total in coal-burning steam locomotive trains	61,803	102,102
4-10	Total in oil-burning steam locomotive trains	37,352	47,417
4-11	Total in Diesel-electric locomotive trains	151,974	129,076
12	Total car-miles per train-miles	9.35	9.14

YARD SERVICE (DATA FROM I.C.C. M-215)

1	Freight yard switching locomotive-hours (000):		
1-01	Steam, coal-burning	1,422	2,247
1-02	Steam, oil-burning	227	321
1-03	Diesel-electric[1]	2,292	1,878
1-06	Total	3,967	4,474
2	Passenger yard switching hours (000):		
2-01	Steam, coal-burning	70	117
2-02	Steam, oil-burning	14	19
2-03	Diesel-electric[1]	229	283
2-06	Total	348	375
3	Hours per yard locomotive day:		
3-01	Steam	7.20	9.30
3-02	Diesel-electric	17.30	18.60
3-05	Serviceable	13.40	13.50
3-06	All locomotives (serviceable, unserviceable and stored)	11.00	11.80
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.99	2.04
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.80	0.78

[1] Excludes B and trailing A units.



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Division reports, the backlog of bad order cars was reduced by 11,000 in March. Mr. King said the information he would get from the C.S.D. under the new service order would keep the I.C.C. up to date on the bad-order situation.

Safety—Hackneyed Word But Vital Force

"The public's acceptance of rail transportation and of individual railroads is based, at least in good part, upon their reputation for safety in carrying passengers and freight," Wayne A. Johnston, president of the Illinois Central, told the Safety Section of the Association of American Railroads at the Midwest Regional Conference in Chicaio, Maf 4. "Safety has played a large part in making the work of the railroads better in every way," he said. "It has saved lives; it has prevented suffering; it has preserved property; it has icproved operations and increased efficiency, and it has idproved our services. It gives confidence to the employee and to the customer. In short, it has been and is today, a truly creative force of the greatest magnitude on our railroads."

"In our shops and roundhouses, employee committees are used to make regular reports of safety hazards. These men are elected by their fellow workers. . . . Usually every second week, but sometimes more often, they make a thorough inspection of the place where they work. They do a painstaking job. A machinist may inspect the cylinder pit, a carpenter the roundhouse, a steamfitter the machine shop."

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE MAY ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	*No. of Units*	*Horse-power*	*Service*	*Builder*
Bessemer & Lake Erie	5	1,500	Road switch	Baldwin Loco.
Central of Georgia	2[1]	2,000	Passenger	Electro-Motive
	2[1]	1,500	Switching	Electro-Motive
	3[1]	1,500	Switching	Alco-G. E.
Chesapeake & Ohio	5[1]	1,200	Switching	Gen. Motors Diesels, Ltd.
	16[1]	1,500	Road switch	Gen. Motors Diesels, Ltd.
Maine Central	8[2]	1,500	Road switch	Electro-Motive
	3[2]	1,200	Switching	Electro-Motive
	2[2]	1,000	Switching	Alco-G. E.
New York, Chicago & St. Louis	4[4]	1,200	Switching	Lima-Hamilton
	3[4]	1,200	Switching	Electro-Motive
	2[4]	1,000	Switching	Alco-G. E.
	1[4]	600	Switching	Alco-G. E.
New York, New Haven & Hartford	20[5]	1,600	Road switch	Alco-G. E.
	10[5]	1,600	Road switch	Fairbanks-Morse
	10[5]	1,200	Yard switch	Lima-Hamilton
Southern	16	1,600	Road switch	Electro-Motive; Alco-G.E.; Fairbanks-Morse
	24	1,500	Freight and passenger road	
Wabash	33[6]	1,500	Freight	Electro-Motive
	3[6]	1,500	Road switch	Electro-Motive
	8[6]	1,200	Switching	Electro-Motive
	2[6]	800	Switching	Electro-Motive
	20[6]	1,500	Freight	Gen. Motors Diesels, Ltd.
	1[6]	1,500	Road switch	Gen. Motors Diesels, Ltd.
	3[6]	800	Switching	Gen. Motors Diesels, Ltd.
	7	1,200	Switching	Lima-Hamilton

FREIGHT-CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Bangor & Aroostook	300[7]	Comb. paper and insulated heater	Major Car
Lake Superior & Ishpeming	50	55-ton box	Pullman-Std.
Mather Stock Car Co.	130	Beef refrigerator	Co. Shops
Reading	500[8]	50-ton box	American Car & Fdry.
	1,000[8]	50-ton hopper	Bethlehem Steel

FREIGHT-CAR LEASES

Delaware & Hudson	500[9]	50-ton box	Pullman-Standard
Pennsylvania	3,000[11]	70-ton gondola	Pullman-Standard
	2,000[11]	70-ton gondola	Bethlehem Steel
	2,000[11]	50-ton box	Pressed Steel
	1,500[11]	50-ton box	American Car & Fdry.
	1,000[11]	50-ton box	General American
	500[11]	50-ton box	Greenville Steel Car

FREIGHT-CAR INQUIRIES

Road	*No. of cars*	*Type of car*	*Builder*
Kansas City Southern	100	50-ton auto	
	300	50-ton box	
Missouri-Kansas-Texas	50-100	70-ton hopper	

PASSENGER-CAR ORDERS

New York Central	1[10]	Rail Diesel	Budd Co.

[1] Delivery expected in July.
[2] Switchers scheduled for delivery in October; the road switchers, for delivery in first quarter of 1951.
[3] Deliveries expected during August and September.
[4] Delivery of the Lima-Hamilton locomotives was expected during May. Delivery of the Electro-Motive locomotives is expected in September and those from Alco-G.E. during June.
[5] Deliveries scheduled to begin late in June and to be completed late in September.
[6] Three of the group of 33 locomotives will comprise one locomotive; the remaining 30, fifteen two-unit locomotives. Two extra four-wheel trucks complete with motors will be delivered with the four 1,500-hp. road switchers. Deliveries of the Electro-Motive units is expected to begin in June and to be completed in September. Delivery of the General Motors Diesels units is expected in October.
[7] For delivery late in September.
[8] Delivery of the hopper cars, which will cost approximately $4,400,000, will begin in June. Deliveries of the box cars, which will cost approximately $2,500,000, are expected to begin in the third quarter of this year.
[9] For delivery next fall. Leased through Equitable Life Assurance Society.
[10] This is the third all-stainless-steel rail Diesel car to be ordered from Budd. To cost $128,500.
[11] Reportedly leased through Equitable Life Assurance Society.

NOTES:

Gulf, Mobile & Ohio.—The board of directors of the G. M. & O. has authorized purchase of 12 Diesel-electric locomotives and 100 70-ton hopper cars.

Nashville, Chattanooga & St. Louis.—The board of directors of the N., C. & St. L. has authorized purchase of 47 Diesel-electric units to cost $6,215,713. The purchase will include 16 1,500-hp. road, 17 1,500-hp. road-switching, 10 1,200-hp. switching and 4 special switching units. All yard and road operations will be completely Dieselized when delivery of these units is completed, which is expected by the end of the year, the road said.

New York Central.—Delivery of Diesel-electric locomotives now on order is expected to increase to more than 35 per cent the New York Central's proportion of Dieselized and electrified mileage, Gustav Metsman, president, says in the road's annual report. The proportion in 1949, he said, was 28.7 per cent, compared with 21 per cent for 1948. "In passenger service," the report added, "34 per cent of our train mileage was performed with Diesel-electric or electric power. Our freight service was 19.1 Dieselized or electrified. In yard switching, 41 per cent of our operations were either Diesel or electric-powered."

Mechanical Division Program

The sessions of the twenty-fourth annual meeting of the Mechanical Division, Association of American Railroads, will be held in the Gold Room of the Congress Hotel, Chicago, June 26 to 28, inclusive. The program will be as follows:

MONDAY, JUNE 26
10:00 a.m. to 5 p.m.*

Address by J. H. Aydelott, vice-president, Operations and Maintenance Department, Association of American Railroads.
Address by The Hon. W. J. Patterson, Member, Interstate Commerce Commission.
Address by Chairman, Mechanical Division, A. E. Galloway, General Superintendent Motive Power and Equipment, Baltimore & Ohio.
Action on minutes of annual meeting of 1949.
Appointment of Committees on Subjects, Resolutions, etc.
Unfinished business.
New business.
Report of General Committee
Report of Nominating Committee
Discussion of Reports on:
Locomotive Construction:
Steam and Electric Locomotives Section
Diesel Locomotive Section
Gas Turbine Locomotive Section
Safety Appliances

TUESDAY, JUNE 27
9:30 a.m. to 5:00 p.m.*

Meeting called to order
Address by Railroad executive
Discussion of Reports on:
Arbitration
Prices for Labor and Materials
Brakes and Brake Equipment
Geared Hand Brakes
Loading Rules
Special Committee on Lumber Loading
Specifications for Materials
Couplers and Draft Gears
Lubrication of Cars and Locomotives
Development of Hot Box Alarm Devices

WEDNESDAY, JUNE 28
9:30 a.m.* until program is completed

Meeting called to order.
Discussion of reports on:
Tank Cars
Wheels
Car Construction
Election of members of General Committee and Committee on Nomination
Report of Committee on Resolutions

* Chicago Daylight Saving Time

Blacksmithing

Parts Forging

Maintenance

Repairs

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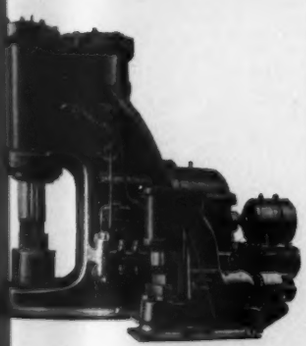

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SUPPLY TRADE NOTES

ELECTRO-MOTIVE DIVISION OF GENERAL MOTORS CORPORATION—*R. L. Terrell*, whose appointment as assistant regional manager, New York region, was announced in the May issue, was born at Dayton, Ohio, in 1918. In 1936 he joined the General Motors Research Laboratory at Detroit, Mich., as an apprentice, and subsequently served 1½ years in the Army Air Forces as an engine mechanic. He returned to the G. M. Research Laboratory

R. L. Terrell

for a short period before joining Electro-Motive Division in 1939 as a service engineer. Two years later he became an installation engineer on G. M. pancake Diesels being installed in SC boats. In 1942 he entered the U. S. Navy as a lieutenant, junior grade, serving in England as an adviser on maintenance of American-built engines on Lord Mountbatten's staff. Mr. Terrell later served with the Bureau of Ships at Washington, D. C., and until V-J day was head of the Navy's internal combustion engine reclamation program. Leaving the Navy in November, 1945, as lieutenant-commander, he returned to E.-M. as sales representative at Washington. He was appointed district sales manager there in October, 1946, and general parts manager at LaGrange in October, 1948.

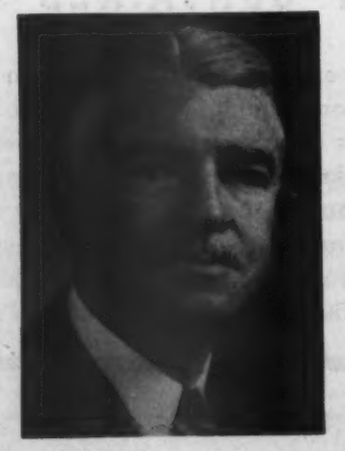
Marvin Anderson, whose appointment as assistant parts manager of the Electro-Motive Division was announced in the May issue, attended the Springfield, Mo., public schools and Drury College, and from 1925 to 1936 gained experience in storage and issue of many kinds of merchandise. Subsequently he joined G.M. Parts Division, holding various supervisory posts in warehousing throughout the country. In April, 1942, he became a warehousing specialist on the staff of the Chief of Ordnance at Washington and in 1943 was promoted to chief of planning for the Storage and Issue Section, Office of the Chief of Ordnance.

Marvin Anderson

Mr. Anderson became associated with E.-M. in September, 1944, as supervisor of warehousing operations. He was appointed parts distribution manager in May, 1948, and assistant general parts manager the following October.

KOPPERS COMPANY.—*John E. Younkin*, district procurement manager of the Wood Preserving division of Koppers at Marietta, Ohio, has been appointed Pittsburgh, Pa., district manager of the division.

H. R. Condon, whose appointment as vice-president and general manager of



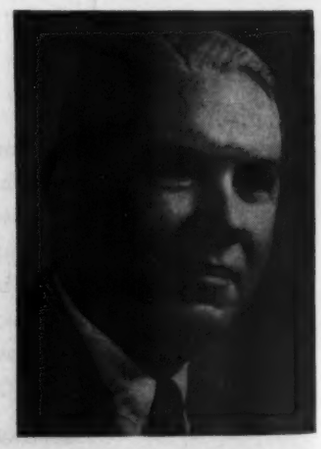
H. R. Condon

the Wood Preserving division of the Koppers Company was announced in the May issue, is a graduate of Pennsylvania State College, with a bachelor of science degree in forestry. Subsequently he became assistant forester and, later, forester of the Pennsylvania. He next became vice-president of the American Mond Nickel Company. In 1929 he was named vice-president of the Century Wood Preserving Company, later merged with Koppers. Mr. Condon, since April,

Walter P. Arnold

1948, has had responsibility for wood preserving activities of Koppers in the eastern half of the United States, with headquarters at Pittsburgh, Pa.

Walter P. Arnold, who has been appointed executive assistant to the vice-president and general manager of the



Frank H. Fischer

Wood Preserving division as announced in the May issue, is a graduate of the University of Cincinnati with a chemical engineering degree. He joined Koppers as a chemical engineer at its Orville, Ohio, plant in 1925. Ten years later he

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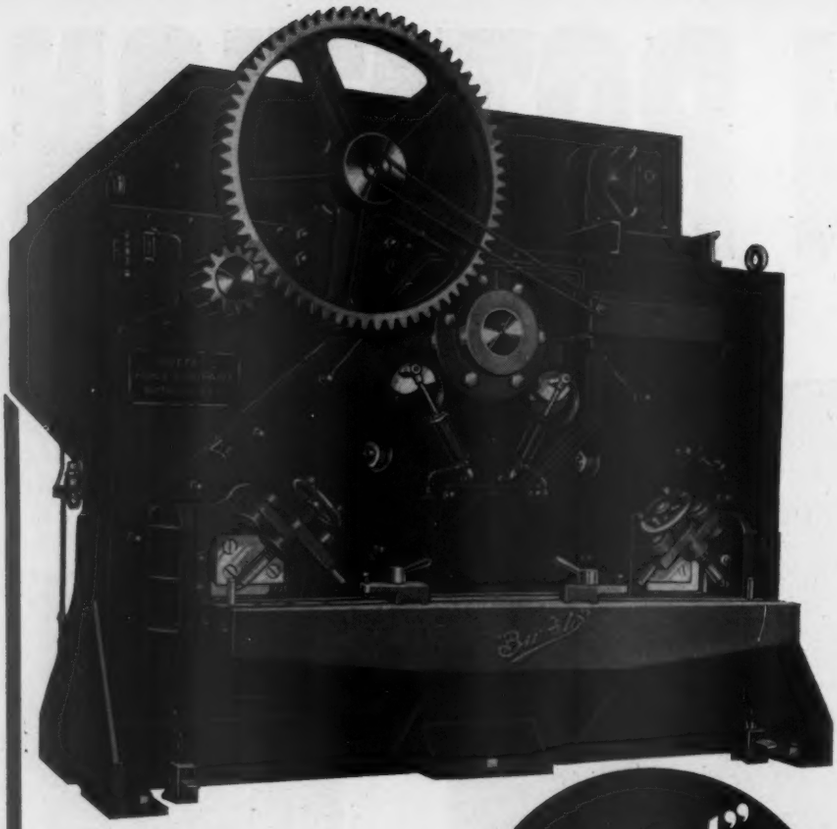

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DRILLING PUNCHING CUTTING SHEARING BENDING

became technical director for the division. In November, 1946, he was appointed manager of railroad sales for the division, with headquarters at Pittsburgh.

Frank H. Fischer, who has been appointed assistant general manager of the Wood Preserving division of Koppers as announced in the May issue, joined a predecessor company of Koppers in 1919, holding positions as purchasing agent and assistant sales manager. When activities of that company were integrated with the Wood Preserving division of Koppers, he was appointed district sales manager for the division. In 1943, he was appointed district manager, with responsibility for sales and production. As assistant general manager Mr. Fischer retains responsibility for railroad sales.

◆

RUST-OLEUM CORPORATION.—*Thomas H. Smith* has been appointed assistant vice-president in charge of railroad sales for the Rust-Oleum Corporation, with headquarters in New York.

Mr. Smith, who will assist the firm's railroad representatives in the eastern region of the United States, began his business career in 1941 with the Hallen Welding Company. In 1942 he enlisted with the U. S. Army Combat Engineers and after his discharge in 1945, joined the freight traffic department of the Pennsylvania. For the past two years he was a sales representative for the Collins Oil & Manufacturing Co.

Thomas H. Smith

◆

GOULD STORAGE BATTERY COMPANY.—The Chicago regional offices of the Gould Storage Battery Corporation have been moved from 175 West Jackson boulevard to 100 East Ohio street.

H. S. Carlsen, whose appointment as assistant to the vice-president, to coordinate railroad sales activities, was announced in the May issue, is located at Trenton, N. J. *F. A. Miller*, formerly district sales manager at New York, has been appointed northeast regional manager, and *Mal Janis*, sales representative in the New York city area for the past seven years, has been appointed district manager. *K. A. Vaughan*, formerly manager field engineering, has been appointed to the newly created position of manager sales engineering. In addition to supervising field engineers and service sta-

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has Many Applications on Railway Electrical Equipment

This low-priced, modern designed, light and easy-to-use addition to the family of Megger Insulation Testers is ideal for the hard, field testing service encountered on railroads.

In addition to the constant-voltage feature, this instrument is available with ohm scale and selector switch in ranges of 0 to 10 megohms, 100 volts d-c; 0 to 20 megohms, 250 volts d-c; 0 to 50 megohms, 500 volts d-c.

Its most important uses include the diagnosis of trouble in all types of electrical equipment, including motors, generators, railway signaling, train control, car lighting and air conditioning.

For complete information and prices, write for *Bulletin 21-80-X* or check the coupon at right.

THE T-21 MEASURES SPEED SIMPLY BY TOUCH—OR BY MOUNTING ON MACHINE

Handy for Use in Railway Maintenance

This new low-priced, miniature FRAHM® Resonant Reed Tachometer is available singly or in kits of three instruments; for hand use or permanent mounting; in ranges from 900 to 13,000 rpm, higher ranges on request.

The T-21 has the advantage of being small and easy to use as a pocket or tool kit instrument and yet easy to read when mounted on a machine. It has no parts to wear out, needs no maintenance, imposes no load on the machine under test, nor can it be damaged by overspeeding.

The simplicity of this resonant reed instrument in no way affects its accuracy—Frahm Tachometers are guaranteed to within 0.5% of their rated frequency of vibration.

For full details on the T-21 Frahm Tachometer, *write for Bulletin 31-35-X* or check coupon below.

Is Your LITERATURE FILE *Up to Date?*

James G. Biddle Company
1316 Arch Street, Philadelphia 7, Pa.

Please mail detailed literature as circled below:

21-20-X 21-80-X 31-35-X

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Job Function _____

Company _____

Address _____

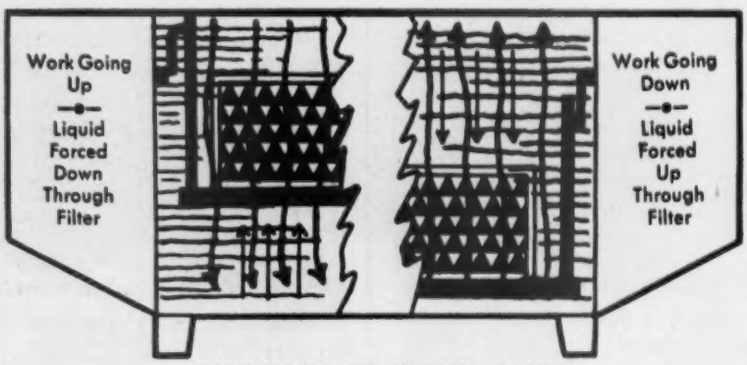
City _____ Zone _____ State _____

PUSH-BUTTON CLEANING

How to clean 40 Diesel Air Filters in 5 minutes*....

and not just surface-cleaned — but completely through, and from corner to corner!

You can clean up to 40 diesel engine air filters, with minimum labor, in 5 minutes when you use the Magnus Air Filter Cleaning Method.



CROSS-SECTION OF MAGNUS AJA-DIP ILLUSTRATING MECHANICAL AGITATION

Here's How: The filters, loaded in baskets, are placed on the agitating platform in a Magnus Aja-Dip Cleaning Machine containing fast-acting Magnus cleaning solution.

By a simple push on the starting button, the filters are automatically and mechanically raised and lowered in the cleaning solution 54 times a minute. The up and down reversing motion of the filters forces the cleaning solution through the filters during the stroke of each motion.

Even the innermost sections of the filter element are stripped of all adhering dust and dirt particles. In fact, the cleaning action is very much like that in a home laundry where the clothes are swished back and forth in the washing solution. *One man can handle the filter cleaning job and still have plenty of time for other work.*

Additional labor savings are made when subsequent rinsing, oiling and drying operations are performed in Magnus Filter Conditioning Equipment.

To improve your filter cleaning, save labor and time— ask Magnus to recommend the set-up for your production.

*40 small filters 9" x 22" x 2¼" or 20 large filters 20" x 20" x 2¼"

Railroad Division

MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.

In Canada—Magnus Chemicals, Ltd. 4040 Rue Masson, Montreal 36, Que.

Magnus CLEANERS AND CLEANING EQUIPMENT

Representatives in all principal cities

tions, Mr. Vaughan also will supervise co-ordination of all matters pertaining to quotations, inquiries, and negotiations.

Mr. Vaughan, who has been associated with Gould since 1928, advanced through every department of the company's Depew, N. Y., plant. In 1934 he was appointed field engineer and, after nine years of field experience, joined the sales staff. He was appointed field engineering manager in 1945.

◆

SKF Industries, Inc.—*Walter S. Corneille* has been appointed manager of the railway sales department of SKF Industries, Inc., succeeding *E. M. Harshbarger* who will retire in July after

W. S. Corneille

23 years of service. *George M. Goodloe* succeeds Mr. Corneille as western railway sales representative, with headquarters in Chicago. Mr. Corneille will have charge of all sales involving ball-

G. M. Goodloe

and roller-bearing applications on steam and Diesel-electric locomotives and passenger cars. Mr. Goodloe, who joined SKF in 1942, served for a time as sales engineer in the Milwaukee, Wis., office.

◆

Youngstown Sheet & Tube Co.—*Frank Purnell* has been elected chairman of the board of directors of the Youngstown Sheet & Tube Co., *J. L. Mauthe*, president, and *Alfred S. Glossbrenner*, vice-president in charge of operations.

Mr. Mauthe, a graduate of Pennsylvania State College, was associated, successively, with the Carnegie Steel Com-

Spring Control Action At its BEST

The spring control in the load-actuated Barber Stabilized Truck adapts itself to all load variations, from empty to capacity, from low to high speeds.

As indicated by the illustrations, after the initial compression of the springs there is a first-stage period of soft damping which gives a soft ride of special benefit to light loads.

Heavy loads and high speeds activate heavier damping action giving unmatched protection against "over-solid" blows.

The side springs also carry their share of the load—a fact now recognized officially by the Car Construction Committee of the A. A. R.

125127

STANDARD CAR TRUCK COMPANY
332 SOUTH MICHIGAN AVENUE, CHICAGO, ILLINOIS

pany; the National Tube Company; the Midvale Steel & Ordnance Co.; the Illinois Steel Company, and the National Tube Company. He joined Youngstown in 1935. In 1937 he was appointed general superintendent of the Youngstown, Ohio, district and in 1943 was elected vice-president in charge of all operations.

◆

BULLARD COMPANY. — "Man-Au-Trol Master of the Machine," "Three for One," and "Bullard Pioneers" are the titles of three 16 mm. sound films produced for the Bullard Company, Bridgeport 2, Conn. The first two of the group show how the Man-Au-Trol vertical turret lathe and the Man-Au-Trol three spindle lathe (Model 30H) are set up and operated; the third, how the Bullard spacer is set up and how it operates. The films run for 27, 18, and 15 min., respectively. They will be loaned by the Bullard Company to any organized groups interested in industrial machinery. Requests should be made at least two weeks in advance of the date of showing.

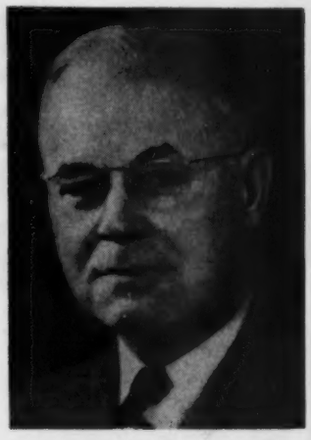
◆

AMERICAN LOCOMOTIVE COMPANY; GENERAL ELECTRIC COMPANY.—"To broaden its service to railroad customers," the American Locomotive Company has assigned field locomotive sales, service and renewal parts authority to the field districts of the General Electric Company. All transactions relative to field locomotive sales and service are now handled through the appropriate General Electric district offices, under the direction of Alco-GE headquarters at Schenectady, N. Y., with *W. S. Morris*, vice-president of American Locomotive Company, in charge. American Locomotive will continue to be the contracting party for all sales, including renewal parts. Its district sales personnel will coordinate their activities through General Electric district offices.

In the sales of products of its Railway Steel Spring and Alco Products divisions, Alco will continue to serve the railroads and industry as a whole from its own district offices.

◆

FAIRBANKS, MORSE & CO.—*O. O. Lewis*, who has been elected vice-president in charge of sales and a director of Fairbanks, Morse & Co. as noted in the May issue, joined the F-M organization in 1908 as a clerk. For a number of years he was a sales engineer in Indiana, Ohio and Michigan territories. In 1932



O. O. Lewis

he was appointed manager of the company's Atlanta, Ga., branch house, and in December, 1943, was moved to Chicago as assistant sales manager. In 1948 he was appointed sales manager. Mr. Lewis is a member of the American Society of Mechanical Engineers, the Society of Naval Architects and Marine Engineers, and the American Society of Naval Engineers, Inc.

◆

HULSON COMPANY.—The O. C. Duryea Corporation, manufacturers of cushion underframes, has been merged into the Hulson Company, Chicago. Hulson will continue and expand Duryea's engineering activities and sales in addition to those of its own established products. Hulson will also continue the Baltimore office of Duryea, but all communications pertaining to the merged companies should be addressed to the principal office of the Hulson Company at 332 South Michigan avenue, Chicago 4.

V. R. Weiss, formerly president of

OVER
3700
In Use

Thousands of installations testify to the savings afforded by the AMESTEAM GENERATOR. This modern boiler is produced by the Ames Iron Works, builders of quality boilers for more than 100 years. Trouble-free—100% automatic in operation, the AMESTEAM GENERATOR requires no chimney draft, only a simple vent to the atmosphere. This rugged unit provides the fuel-saving advantages of a thermal efficiency of over 80%.

Ideal for low-pressure heat in station or shop, also for high-pressure work for sand drying, Diesel de-icing and a host of other railroad applications.

Single units from 10 to 500 H.P. Higher horsepower available on special order. Suitable for multiple installations. Design pressure—15 to 200 lbs. Higher pressures on order.

Delivered complete ready for service connections—including insulation and jacket. *Phone, write or wire.*

Here's Why

80% Thermal Efficiency
100% automatic
Abolishes boiler room labor
Uses oil or gas fuel or a combination of both
No smoke — no soot
Takes up ⅓ the space of conventional boilers
Suitable for multiple installations
Delivered complete ready for service connections

NO BOILER ROOM LABOR REQUIRED

Exclusive Distributors to the Railroads
Engineering, Sales and Service
RAILROAD SUPPLY and EQUIPMENT Inc.
148 ADAMS AVE., SCRANTON 3, PA.
Phone Scranton 7 3391

our greatest contribution to freight progress

MINER CLASS A-22-XL GEAR

Duryea, has been elected a director of the Hulson Company. *J. R. Gillette*, vice-president of Duryea, has become a vice-president of Hulson with headquarters in Chicago, and *W. E. Heaton* continues for Hulson in Baltimore, Md. *S. Simonson*, chief engineer of Duryea, remains in charge of all engineering, service and inspection relating to Duryea production, with headquarters as before at Butler, Pa.

◆

GRAYBAR ELECTRIC COMPANY.—The Graybar Electric Company has divided its southwestern district, at Dallas, Texas, into two units, the new district being called the Gulf Coast district, with headquarters at Houston, Texas. Both districts will continue to operate under the supervision of *G. T. Marchmont*, district manager. Branch houses reporting to Houston will be Beaumont, Texas, and Corpus Christi; New Orleans, La., and Jackson, Miss. Branch houses continuing to report to Dallas are San Antonio, Texas, Fort Worth, and Amarillo; and Shreveport, La. *J. E. Fontaine*, formerly Houston manager, has been appointed assistant district manager in charge of the new district, and *A. W. Palin*, formerly operating manager at Houston, has been appointed district operating manager for Houston and its branches.

◆

UNION ASBESTOS & RUBBER CO.—*James H. Watters*, president of the Union Asbestos & Rubber Co., with headquarters at Chicago, has been elected chairman of the board. *Norman C. Naylor*, vice-president at Chicago, succeeds Mr. Watters as president.

Mr. Naylor was associated with the American Locomotive Company as vice-president in charge of western sales of-

Norman C. Naylor

fices from 1930 to 1947, and subsequently served as vice-president in charge of sales at New York. He became vice-president of Union Asbestos in July, 1948. From 1943 to 1947 he was president of the Railway Supply Manufacturers Association, and is now chairman of the executive committee of the Railway Business Association.

◆

BALDWIN LOCOMOTIVE WORKS.—*Edmond J. Hagan* has been appointed sales representative for the press and power tool department of the Baldwin Locomotive Works. Mr. Hagan will cover northern New Jersey, New York, and New England, with headquarters at the New York district sales office.

◆

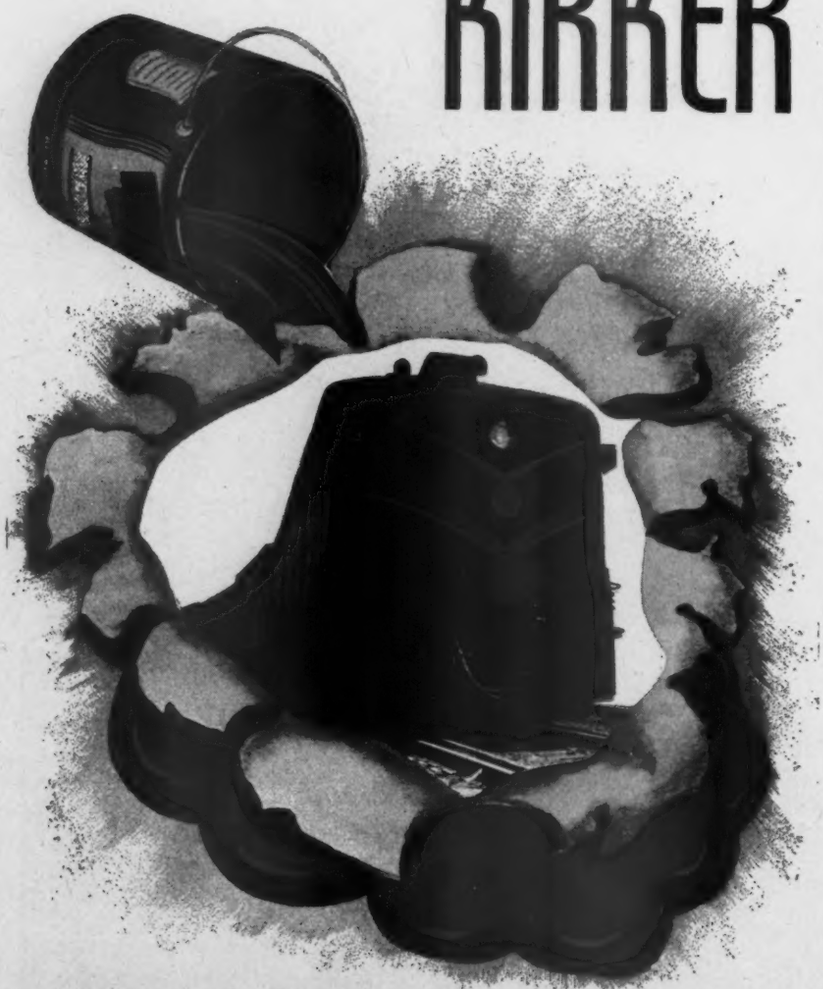
COMBUSTION ENGINEERING - SUPERHEATER, INC.—*H. G. Ebdon* and *William P. E. Ainsworth* have been elected vice-presidents of Combustion Engineering-Superheater, Inc., New York.

Mr. Ebdon joined the company in 1917 and since 1925 has served successively as manager of the Proposition Department; sales engineer, New York district office and assistant general sales manager. In 1941 he was appointed general sales manager of boilers and related equipment. He will continue in the latter capacity, working in association with Donald S. Walker, the company's vice-president and director of sales.

◆

B. S. WILLIAMS COMPANY.—The B. S. Williams Company has been established with factory and engineering offices at 6 North street, Mount Vernon, N. Y., to design, develop and manufacture railroad air-conditioning and refrigerating equip-

KIRKER



Railway Finishes of Superior Quality

A system of railway finishes custom built to your production requirements and combining exceptional adhesion, high-gloss retention, and durability. In lacquer and synthetic.

KIRCO Kirker CHEMICAL COMPANY

ONE EAST ELEVENTH STREET • PATERSON 4, NEW JERSEY

REPLACE DIESEL TRUCKS — QUICKLY • SAFELY
with a WHITING DROP TABLE

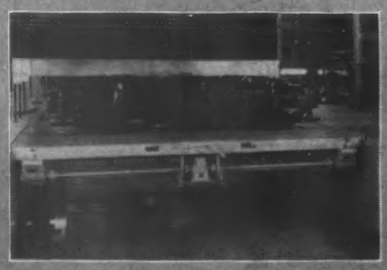
Photos Courtesy Chicago & Eastern Illinois Railroad

TODAY—499 Whiting Drop Tables are operating in both steam and Diesel repair shops on 114 railroad systems. This alone is a testimonial of the valuable service Whiting Drop Tables have been contributing to railroad maintenance even before the days of the Diesel.

Another proved design, the Whiting Consolidated Drop Table, is built specifically to drop Diesel trucks and replace them with stand-by units quickly and safely. The Whiting Consolidated Drop Table can be incorporated into existing repair shops easily, because only a shallow pit is necessary. This means a saving in excavation and concrete costs.

Whiting Drop Tables are available in a variety of styles and sizes. They will speed the job of dropping wheels or complete trucks on either Diesel-electric or steam locomotives, tenders, and coaches. Write for more information.

Whiting Drop Table racked to release track ready to be raised



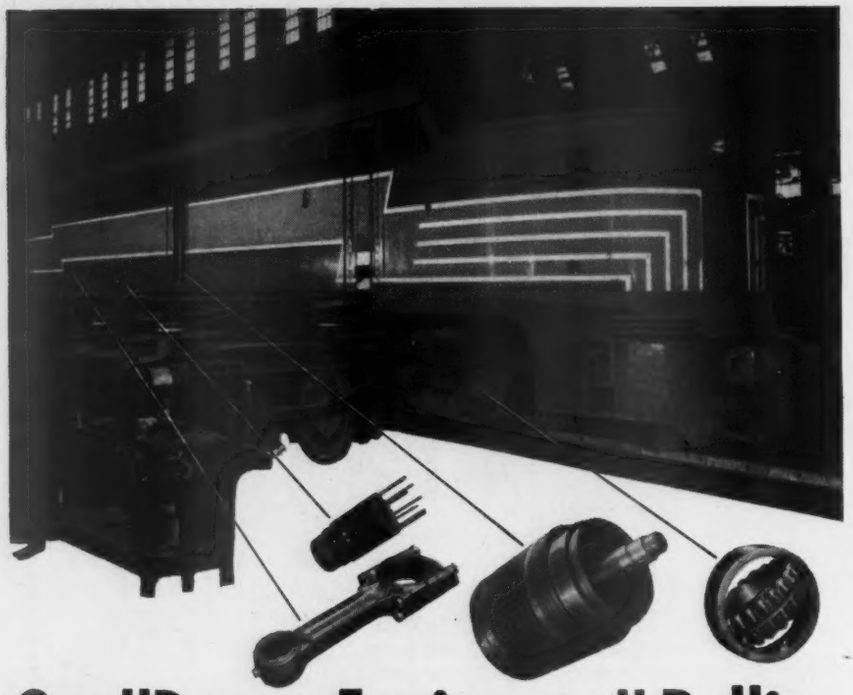
Six-wheel truck on Whiting Drop Table at release position

WHITING CORPORATION

15609 Lathrop Avenue, Harvey, Illinois

RAILROAD MAINTENANCE EQUIPMENT

Offices in Chicago, Cincinnati, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, and St. Louis. Representatives in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Ltd., Toronto, Ontario. Export Department: 30 Church Street, New York 7, N. Y.



Get "Down-Equipment" Rolling economically – speedily!

It would be ideal if equipment "down-time" could be entirely eliminated. However, periodic inspections and overhauls are necessary for safe and efficient operation. Don't let inefficient, outmoded metal parts cleaning methods tie up your equipment. Get "down-equipment" rolling!

Designed especially to handle railroad cleaning problems including those encountered in diesel service shops, the Circo C-120 vapor-spray degreaser does away with costly hand-labor operations. Circo installations throughout the country attest to the efficiency and speed of the vapor method for cleaning armatures, field frames, housings, axle caps, roller bearings and most other parts and assemblies. *Savings of over 90% in time alone are common.*

Not only is valuable time saved but better cleaning is assured. Warm vapor, harmless to all metals, thoroughly penetrates every crack or seam. All traces of dirt, oil and grease are absolutely removed, leaving each part ready for immediate inspection. Depending on size, parts can be removed, *absolutely clean and dry,* in 1 to 15 minutes. Best of all, Circo's fully automatic control system guarantees operating economy.

Circo Model C-120
Cleaning capacity
18000 lbs. per hour

A CIRCO engineered degreaser gives you

1. Thorough and speedy parts cleaning
2. Safe operation—uses a nonflammable, non-explosive solvent
3. Economy of operation
4. Long life with stainless clad, nickel clad or zinc sprayed construction.

CIRCO DEGREASERS PAY FOR THEMSELVES

For detailed information send for our catalog. Our engineers will gladly work with you on metal cleaning problems requiring equipment of special design. A-3054

CIRCO

CIRCO PRODUCTS COMPANY
Metal Cleaning Equipment
6531 EUCLID AVE. • CLEVELAND, OHIO

PIONEERS IN THE DEVELOPMENT OF HOT VAPOR CLEANING EQUIPMENT

ment. The company will also operate a factory-rebuilding and accessory-parts service and will handle liquid cooling and other specialized applications in the industrial and commercial fields. *B. S. Williams,* president of the new company, was previously director of industrial research for the Airtemp Division, Chrysler Corporation. Prior to his connection with Chrysler, he had been with the York Corporation.

◆

WHITCOMB LOCOMOTIVE COMPANY.—*Charles K. Olson,* general manager of the Whitcomb Locomotive Company at Rochelle, Ill., has been elected assistant vice-president and general manager of the company.

◆

ALAN WOOD STEEL COMPANY.—*W. E. Bossert* has been appointed New York district sales manager for the Alan Wood Steel Company, Conshohocken, Pa., to succeed *W. H. Dickson,* who has retired after 41 years of continuous service.

Mr. Bossert joined Alan Wood in July, 1910, and, except for service in World War I and with the War Production Board from July, 1942, to October, 1944, his association with the company has been continuous.

Obituary

JOHN F. DEEMS III, vice-president and director of the Magnus Brass Manufacturing Company and manager of the Magnus Brass division of the National Lead Company, died on May 17 at Cincinnati, Ohio, after an operation.

Mr. Deems was born on July 9, 1910, at Tupper Lake, N. Y. He was graduated from Columbia College in 1932 and during his summer vacations worked on the Lehigh Valley, the Baltimore & Ohio, the Delaware, Lackawanna & Western and the Delaware & Hudson. In 1932 he joined F. G. Shattuck & Co. From 1933 to 1935 was associated with the Horn & Hardart Co. and in the latter year he joined the Union Asbestos & Rubber Co. as service engineer. From 1939 to 1943 he worked for the Edna Brass Manufacturing Company. When the assets of the latter company were acquired by the National Lead Company, he assumed the positions he held at the time of his death.

John F. Deems

It's FAIRBANKS-MORSE

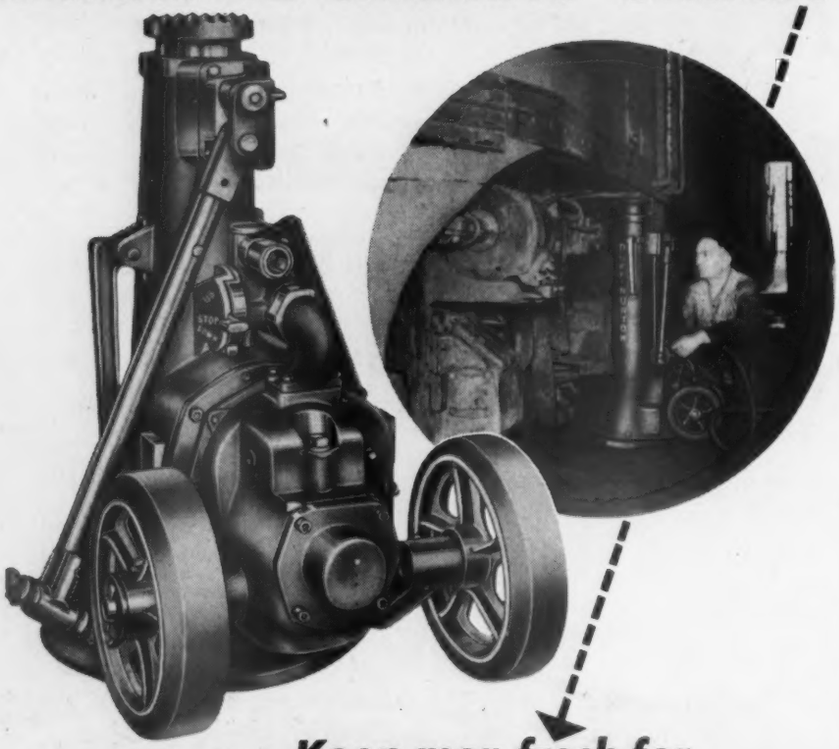
...Consolidation...

ROAD FREIGHT POWER

for the NEW YORK CENTRAL

Newest, finest 4000 hp. freight locomotives — each unit powered by a 2000 hp. Opposed-Piston diesel. A number of these C Line Locomotives are now being delivered to the New York Central. Fairbanks, Morse & Co., Chicago 5, Ill.

ELIMINATE JACKING STRAIN



Keep men fresh for repair and maintenance work with

DUFF-NORTON
air motor power jacks

All types of locomotives can be lifted and lowered with effortless ease . . . with Duff-Norton Air Motor Power Jacks. Absolutely safe and dependable, they can be controlled to within a fraction of an inch. Easy to spot—easy to handle—they hold loads for long periods of time without danger of creepage or sinking.

QUICK REFERENCE FOR JACK SIZES

Jack No.	Capacity Tons	Height Inches	Raise Inches	Base Diam. Inches	Head Diam. Inches	Weight Pounds
228-R	20	28	18	12	4	238
528-RX	50	28	17	14	5	370
536-RX	50	36	25	15	5	395
126-RX	75-100	26	14	13	6½	448
144-RX	75-100	44	30	18	6½	530

Two Air Motor Power Jacks can be used simultaneously with "Y" connection on air hose.

STRENGTH. SAFETY. DURABILITY. DUFF-NORTON JACKS ESTABLISHED 1883

THE DUFF-NORTON MANUFACTURING CO.
Main Plant and General Offices, PITTSBURGH 30, PA. Canadian Plant, TORONTO 6, ONT.
"The House that Jacks Built"

HAROLD F. WELCH, sales manager of the New York district, Pratt & Whitney division, Niles Bement Pond Company, until his retirement last year, died at St. Thomas, Virgin Islands, on May 5.

◆

WALTER F. HEALY, manager of railway sales for the Union Metal Manufacturing Company, Canton, Ohio, died on April 18, in Indianapolis, Ind. Mr. Healy was 59 years old.

PERSONAL MENTION

General

C. N. WIGGINS, general master mechanic of the Louisville & Nashville at Louisville, Ky., has been appointed assistant superintendent of machinery, with headquarters at Louisville. Mr. Wiggins was born on October 29, 1914, at Shelbyville, Tenn., and is a graduate of Mississippi State College with a B.E. degree in mechanical engineering in 1939. In September of that year he entered the

C. N. Wiggins

service of the L. & N. as a special apprentice at the road's South Louisville, Ky., shops. In September, 1942, he was appointed a machinist, and in July, 1943, assistant general foreman at South Louisville. He was transferred to Corbin, Ky., as assistant general foreman in February, 1945. The following May he was promoted to general foreman at Corbin. He became assistant general master mechanic at Louisville in April, 1947, and general master mechanic in January, 1948.

J. W. HAWTHORNE, assistant chief of motive power and equipment of the Atlantic Coast Line, has been appointed general superintendent motive power and equipment, with headquarters at Wilmington, N. C. Mr. Hawthorne was born at Williamsport, Pa., on March 29, 1911,

ONE OF AMERICA'S LEADING SUPPLIERS OF LEASED TRANSPORTATION EQUIPMENT CHOOSES

General American-Evans Company, in providing railroads and shippers with the most modern transportation equipment, has chosen NAILABLE STEEL FLOORING for its new cars. Such cars, leased to railroads, will increase the supply of box cars equipped to transport shippers' goods with greater safety and improved revenue to the railroads.

NAILABLE STEEL FLOORING has been chosen for these cars because General American-Evans knows that steel flooring provides increased overall structural strength to the cars and has proved in service to be safe, sure, and efficient.

This modern construction is a guarantee that today's mechanical handling equipment can be used by shippers without danger of car floor break-throughs and that goods will be safer in transit. These cars represent the ultimate in versatility of use to meet modern transportation requirements.

NAILABLE STEEL FLOORING

PATENTS PENDING

N-S-F HOLDS BLOCKING BETTER — A GREAT LAKES STEEL PRODUCT

50-SF-8A

Left:
New General American-Evans car showing type of lift truck loading method that requires N-S-F for safety

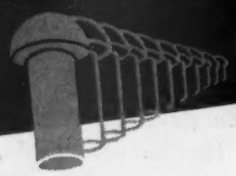
GREAT LAKES STEEL CORPORATION

Steel Floor Division • Ecorse, Detroit 29, Michigan

UNIT OF NATIONAL STEEL CORPORATION

Further information on NAILABLE STEEL FLOORING is available from sales representatives in Detroit, Chicago, Philadelphia, St. Louis, Atlanta, San Francisco.

PROPERLY HEATED RIVETS at a SAVING!



with a JOHNSTON RIVET FORGE!

Save oil, save time, cut costs! The Johnston Rivet Forge is outstanding for its economy, for its ability to hold adjustment and operate steadily without attention.

It's equipped with the proven Johnston non-clogging vacuum oil burner. Because it's engineered with experience there's no oil valve—no small passage to clog! It's available in portable or stationary types. For safety, for dependability, for economy, order the Johnston Rivet Forge!

Write For Bulletin R-801

Over Thirty Years Experience in Design and Manufacture of Burners • Blowers • Furnaces • Rivet Forges • Fire Lighters • Tire Heaters • And Allied Equipment

THE JOHNSTON LINE — SAFETY — DEPENDABILITY

JOHNSTON MANUFACTURING CO.
2825 EAST HENNEPIN AVE.
MINNEAPOLIS 13, MINN.

ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

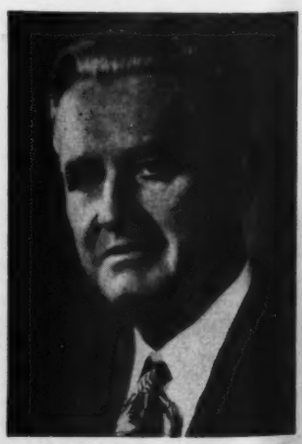
AMERICAN-FORT PITT
SPRINGS
GOOD RIDING BEGINS WITH Good Springs
For more than sixty years, American-Fort Pitt Springs have proved that quality in springs goes hand-in-hand with economy. The better the springs the better the ride, less damage to lading, less cost for maintenance, and a smoother journey for the passenger. American-Fort Pitt Springs owe their quality to extraordinarily skillful engineering and design, up-to-date equipment, and automatically-controlled heat treatment. American-Fort Pitt railroad springs meet AAR and ASTM specifications. Write for a copy of the American-Fort Pitt handbook on springs.
AMERICAN-FORT PITT SPRING DIVISION
PORTER
"Better Built" EQUIPMENT
AMERICAN-FORT PITT SPRING
Division of H. K. Porter Company, Inc.
2 John St., McKees Rocks, Pennsylvania

and attended Purdue University (B.S. M.E. 1933). He began his career with the New York Air Brake Company at Watertown, N. Y., in July, 1933, transferring to Cleveland, Ohio, in July, 1936. From January to July, 1940, he was a special representative of the Chesapeake & Ohio, then returning to New York Air Brake at Cleveland until October, 1943.

J. W. Hawthorne

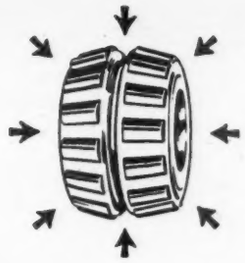
On November 1, 1943, he was appointed assistant superintendent motive power of the Central of Georgia and on January 1, 1945, to superintendent motive power. He became assistant chief of motive power and equipment of the A.C.L. at Wilmington on January 1, 1949.

JOHN F. RYAN, who has been appointed superintendent of machinery of the Louisville & Nashville at Louisville, Ky., as announced in the May issue, received his education at Bethel College, Russellville, Ky., and at St. Mary's College, St. Mary's, Ky. He entered L. & N. service in January, 1910, as a machinist



John F. Ryan

apprentice in the roads shops at Russellville, completing his apprenticeship in 1914. Subsequently he served as machinist and locomotive fireman on the Owensboro and Nashville division until 1917, when he was transferred to Ravenna, Ky., as a machinist. In 1918 he was appointed night foreman at Ravenna, and later became enginehouse foreman and general



1. SIMPLICITY ITSELF: Due to tapered construction, Timken roller bearings take both radial and thrust loads in any combination. The need for special thrust bearings or thrust blocks is eliminated.

2. ROLLS UNIFORMLY SIZED for their particular cup and cone. Each roll carries its full share of the load.

3. NO LATERAL SLIDING FRICTION in a Timken bearing, due to its tapered design.

4. ROLLS STAY PUT . . . FOR LIFE! The rolls in a Timken tapered roller bearing are permanently retained in the bearing assembly. Can't fall out and pick up dirt during bearing changes.

5. HARD ON THE OUTSIDE—TOUGH ON THE INSIDE! Rolls and races made of Timken fine alloy steel with wear-resisting surface and tough, shock-resistant core.

6. USE EITHER OIL OR GREASE!

7. NO ROLL SKIDDING OR SKEWING! Cone rib keeps tapered rolls in positive alignment. Load is spread over full roll length.

8. NO ADJUSTMENTS NEEDED when wheel and axle assembly are installed in the truck.

9. AXLE MAGNAFLUX INSPECTION SIMPLIFIED! Bearings press off with the wheel.

10. POLISHED AXLE ENDS AREN'T NECESSARY! No thrust block used.

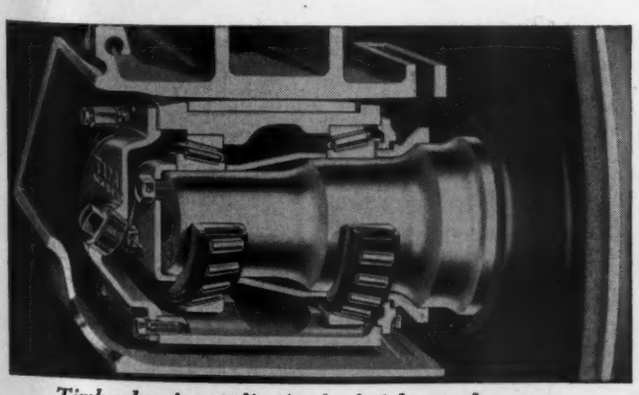
11. SPECIAL AXLE LENGTH TOLERANCES NOT REQUIRED!

USED ON OVER 5,000 PASSENGER CARS, OVER 6,000 STEAM, DIESEL AND ELECTRIC LOCOMOTIVES, 3,900 FREIGHT CARS!

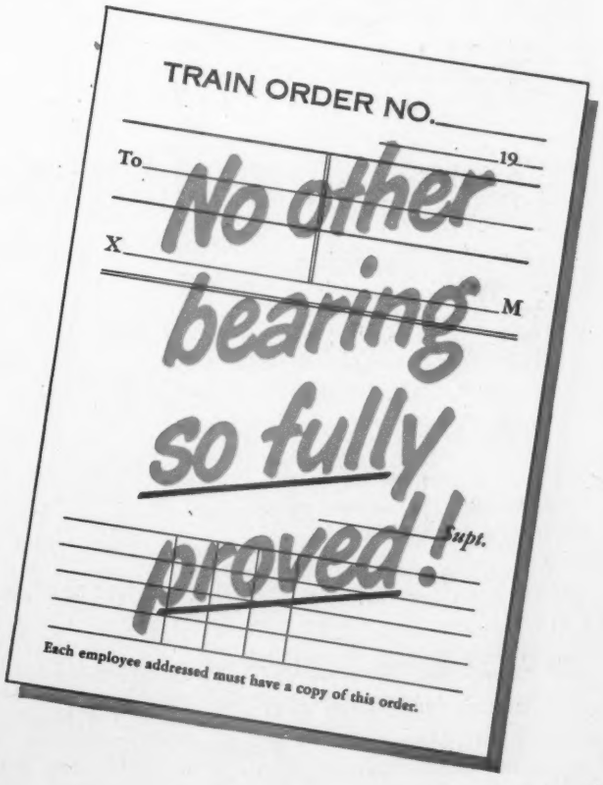
Pioneer of anti-friction bearings for railroads, Timken® has remained the leader ever since.

The advantages of Timken bearings have been conclusively proved in every type of railroad operation. Over 5000 passenger cars roll on Timken bearings—more than on any other make of anti-friction bearing. Over 3900 freight cars roll on Timken bearings—more than on any other make of anti-friction bearing. Over 4000 steam locomotives roll on Timken bearings—more than on any other make of anti-friction bearing.

Let us help you with your bearing applications. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".



Timken bearing application for freight car changeovers.



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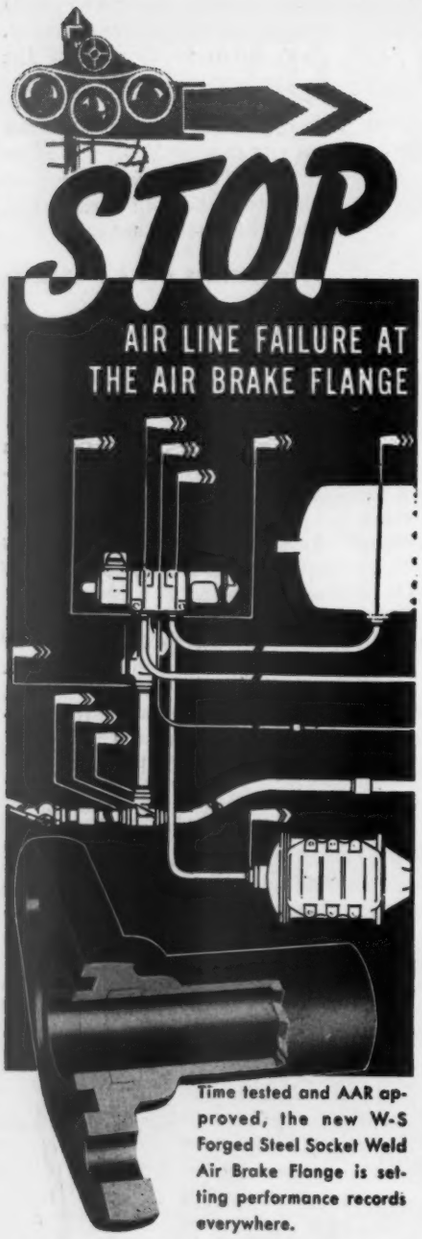

Time tested and AAR approved, the new W-S Forged Steel Socket Weld Air Brake Flange is setting performance records everywhere.

One piece drop forged for strength . . . it's lighter in weight, less cumbersome to handle, and is shock resistant.

A W-S representative (listed below) will be glad to explain how safe, efficient and economical it is.

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New York, N. Y.....Eastern Railway Supplies, Inc.
St. Paul, Minn.....Anderson Machine Tool Co.
San Francisco, Calif.....Overland Supply Co.
Washington, D. C.....Ralph Payne
9-K-11

foreman. He was appointed master mechanic in 1940, general master mechanic at Louisville in January, 1944, and assistant superintendent of machinery in January, 1948.

A. D. BINGHAM, assistant to general superintendent equipment of the New York Central at New York, retired on May 1, after 41 years of service.

W. G. RINGLAND, master mechanic of the New York Central at Albany, N. Y., has been appointed assistant superintendent equipment at New York.

LORENZO VALADEZ VALDES has been appointed acting superintendent of machinery and motive power of the National of Mexico.

J. H. WHIPPLE, JR., assistant superintendent of Diesel equipment of the Denver & Rio Grande Western at Denver, Colo., has been appointed general mechanical inspector of the Chicago, Rock Island & Pacific.

W. C. WARDWELL, assistant superintendent equipment of the New York Central at New York, has been appointed assistant to general superintendent equipment.

W. E. BUCK has been appointed general supervisor machinery and production of the New York Central System at New York, with supervision over the shop machinery and tool committee at Buffalo and supervisors of production at steam locomotive shops.

Car Department

GEORGE O. PROSSER has been appointed superintendent—car department of the Kentucky & Indiana Terminal at Louisville, Ky.

Master Mechanics And Road Foremen

W. E. ANDERSON, division general car foreman of the New York Central at Toledo, Ohio, has been appointed assistant master mechanic at Chicago. The position of division general car foreman has been abolished.

W. H. CHIDLEY, master mechanic of the Boston & Albany at Boston, Mass., has been appointed master mechanic of the New York Central at Albany, N. Y. The position of master mechanic at Boston has been abolished.

H. L. CRANE, acting master mechanic, Wyoming division, of the Union Pacific, has been appointed master mechanic of that division, at Cheyenne, Wyo.

CARL A. LOVE, assistant general master mechanic of the Louisville & Nashville at Louisville, Ky., has been appointed general master mechanic at Louisville. Mr. Love, a graduate of Vanderbilt University's College of Engineering, started his career with the L. & N. in June, 1939, as a special apprentice at South Louisville, and subsequently served as machinist until November, 1943, when he was appointed assistant general foreman, serving, successively, at the South Louisville machine shop, at the South Louisville enginehouse and at Boyles, Ala. Mr. Love served as general foreman at Paris, Tenn., and at Boyles, prior to his appointment in January, 1948, as assistant master mechanic at Louisville.

Carl A. Love

L. J. GARRETT, master mechanic, Central region, of the Pennsylvania at Cleveland, Ohio, has been transferred to the position of master mechanic, Western region, with headquarters at Ft. Wayne, Ind.

E. L. HYATT has been appointed assistant master mechanic of the Boston & Albany at Boston, Mass., in which capacity he will continue to have jurisdiction over the West Springfield (Mass.) Diesel shop.

H. W. RASOR, master mechanic of the New York Central at Chicago, has been given jurisdiction over the equipment department, including both locomotive and car departments, on the Toledo-West and Western divisions.

B. W. SWAIN, general foreman of the St. Louis-San Francisco at Sherman, Tex., has been appointed master mechanic, with headquarters at Sherman.

E. M. VANDIVER, acting master mechanic, Arkansas division, Missouri Pacific, at North Little Rock, Ark., has been appointed master mechanic at North Little Rock.

Obituary

WILLIAM R. MCMUNN, retired special assistant to vice-president and general manager of the Merchants Despatch Transportation Company, died on May 10 at the age of 74.

GEORGE SCHEPP, master mechanic, Arkansas division, Missouri Pacific, at North Little Rock, Ark., died on April 16 at Little Rock.